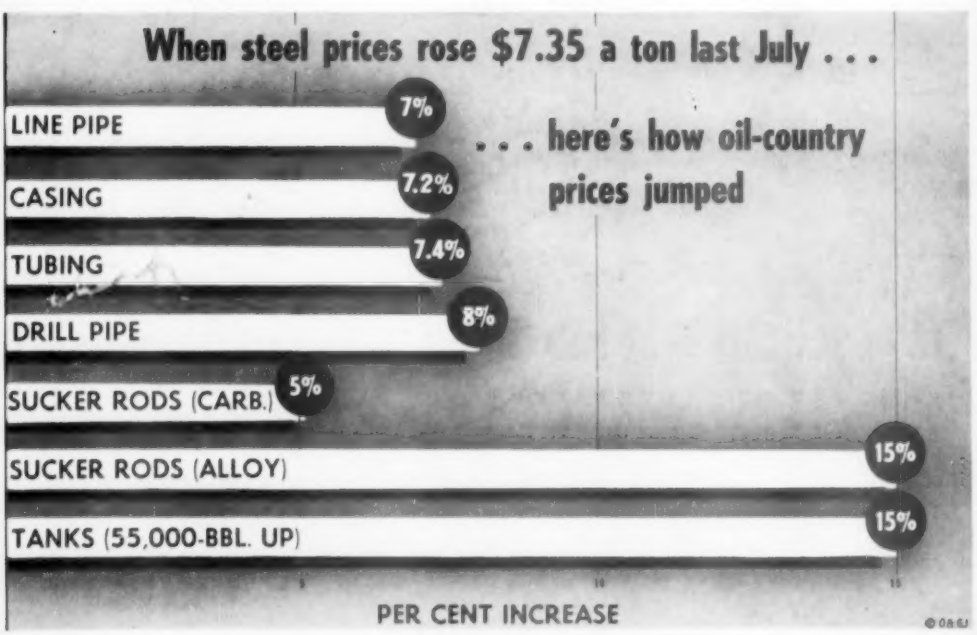
the OIL AND GAS JOURNAL

MAY 28, 1956

IF AND WHEN . . .

STEEL HIKES PRICES . . .

. . . How will oil be hit? Here's a clue



For a realistic appraisal of what's ahead, see page 82.

Latest refining and pipelining technology in eight articles from A.P.I. meetings

. . . Starting on page 112

Illustrated — UNIBOLT Flow Manifold with Plug-Lok and Gauge Valve-Connector. Available in 3000, 5000 and 10,000 lbs. w.p.

UNIBOLT started something with this FLOW MANIFOLD!

It started a new trend in Christmas tree flow controls — the fabrication of salvageable parts into a compact, strong, lightweight, economical unit that provides everything necessary above the master valve. When you consider all of its mechanical advantages (more than two dozen of them) you, too, will agree that there is no other production control unit that gives you so much honest value for your Christmas tree dollars.

Add to this the fact that UNIBOLT Flow Manifolds eliminate impingement of flow and negative pressure areas, may be salvaged completely or as separate units, and provide flexibility in arrangement of connections.

We will gladly send you complete details on this, the best buy in flow manifolds.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Pipeline movement of imported crude from the East Coast to refineries as far west as Ohio is a definite possibility.

Studies indicate such shipments, in old or new lines, would be fully competitive with crude from Mid-Continent and Rocky Mountain states. Gasoline from imported crudes now is being piped westward in competition with inland-refinery products.

Owners of 1956-model cars are getting fewer miles per gallon. Official tests show that mileage has dropped in the past year. This reverses a trend of several years and may have an important effect on future gasoline demand. The development may be the start of a new mileage trend which will extend through 1957 and beyond.

A growing practice in West Texas has drilling contractors worried. Some operators are docking the contractor 1/15 of his day-work rate whenever one drilling-crew member fails to report for work.

These operators figure the contractor is putting three five-man crews to work for 15/15 of the day-rate price. The contractors aren't happy. In effect, they say, the policy means they are getting paid only for their labor, with no compensation at all for other costs or their risks.

A sulfur plant is being planned at Montreal to process the hydrogen sulfide from the five refineries in the Montreal East area. These plants charge sour Middle East and Venezuela crudes predominantly. From the area's total throughput of 240,000 bbl. per day, some 1,000 to 2,000 tons of sulfur per day is available.

Oil operators in the Ohio River valley may soon be faced with a set of stringent regulations on waste disposal into the Ohio and its tributaries. A stream pollution organization with members from several states is currently inviting industry representatives to meetings to talk over their problems. Both process plants and production operations with brine-disposal problems may be affected.

California soon may step up its drive to cut down air pollution. The U. S. Supreme Court has thrown out a challenge of the state "smog control" law by Union Oil Co. of California. The court held no federal issue is involved in California's crackdown on pollution.

Whether the 100-octane third grade spreads throughout the U. S. or not, refiners face the necessity of adding more catalytic reforming capacity.

Few refiners are now without it, and several are beginning their second round of reformer construction. How high is saturation? Gulf is building two Platformers to augment one now operating at the Philadelphia refinery. They will bring total catalytic reforming capacity there to more than 35 per cent of crude capacity.

the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY–OPERATION

Pipelining

Determining the Power Loss in Pipeline Pumps **136**

By G. J. Jennings and L. P. Meade

Temperature rise in a pipeline pump can now be measured and converted to horsepower loss and efficiency. The procedure is inexpensive and simple. Numerous tests have proved the accuracy of the method.

Pipeline Problems Yield to Electronic Computations **146**

By D. L. Fayman

Great Lakes Pipe Line Co. has applied a computing machine to the problem of scheduling movement in a complex pipeline network. Anticipated result is that the system can be operated at a higher level of efficiency than ever before.

Pipeline Patrol: Construction **153**

Refining—Processing

Keep Those Maintenance Costs in Line **112**

By E. S. Bale, E. L. Mast, and R. E. Webster

Experience at Standard Oil Co. of Ohio's Cleveland refinery shows that the best way to compare refinery-maintenance costs is on the basis of ratios of current cost to capital invest, in terms of current dollars.

Computers Solve Basic Refinery Problems **116**

By Jack Sherman

Use of a high-speed computer greatly increases the amount of computation which it is practical to perform in a refinery. It puts the refinery in much better position to meet unexpected situations and liberates the process engineer from tedious calculations.

How Sun Oil Licked Its Waste-Disposal Problem **118**

By Harold F. Elkin

The system at Sun's Toledo refinery provides for comprehensive pollution control of spent waters for reuse and a virtually unlimited water supply for emergency fire protection.

How to Mitigate Corrosion in Catalytic Reformers **121**

By B. W. Neumaier and C. M. Schillmoller

Richfield Oil Corp. has plotted anticipated maximum corrosion rates at various points in the reformer and hydrodesulfurizer units. Metallurgical selections for various parts of the units are based on these curves.

What's the Score on Automatic Process-Stream Analyzers **125**

By T. C. Wherry

A number of automatic process-stream analyzers have been developed from established laboratory techniques and applied in commercial operations. There should be a continuation of this trend.

Computers Aid in Refinery Economic Planning **131**

By Robert G. Donovan and Robert W. Schrage

The most important use of computers in petroleum refining is in economic planning of refinery operations. This results in much more effective performance from the refinery staff.

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Drilling—Production

Sun's New Diesel Rig Has Flexibility and Portability **108**

By Ed McGhee

One of the most highly portable big rigs yet put in service on the Gulf Coast.

How to Rod-Pump Those High-Angle Offshore Wells **144**

By D. H. Stormont

The problems of pumping are getting rods to fall, rod stretch, and rod overtravel.

On-The-Job—In The Field **146**

Simplified automatic drilling equipment—Derrick man's elevator—Tool logs and perforates in one run—Flag signal saves false stops for gager.

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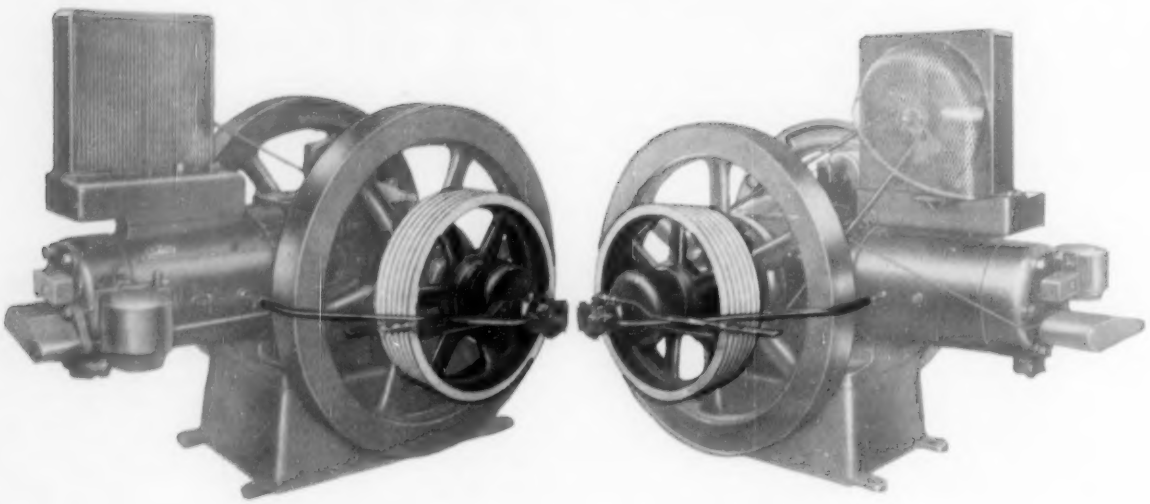

on the "ZC"

The clutch and sheave can be mounted on either end of your Fairbanks-Morse ZC engine crankshaft—whichever end will position the engine most conveniently on the floor plan of your pumping rig. This feature, unique in the ZC, makes for safety of operation and ease of service.

The Fairbanks-Morse ZC engine has TWO flywheels. However you mount the clutch and sheave, there will be the smoothing effect of a flywheel between the engine and the fluctuating power demand of the pump jack. This makes for better balance and more economical operation.

There are six sizes of ZC engines, from three horsepower to 30. See your local supply store or write Fairbanks, Morse & Co., Oil Field Division, 600 South Michigan Avenue, Chicago 5, Illinois.

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B.F.Goodrich

2½ years, 200,000 feet with one set of B. F. Goodrich V belts

A typical example of B. F. Goodrich improvement in rubber

YOU oil men know how costly a belt breakdown can be on a mud pump drive. That's why the tool pusher shown above depends on B. F. Goodrich Grommet V belts to keep pumps running without expensive downtime for repairs and replacements. On one of his rigs, a set of Grommet belts lasted 2½ years, drilled 200,000 feet of hole.

Grommet belts not only outlast other V belts, they outperform them too, according to this tool pusher. He says, "... the Grommet V belt is the most positive and reliable power transmitter we have ever used. The 'power loss' is so small that you can hardly figure it."

Grommets are two extra strong cord loops inside the belts, like twisted cables except that they're endless. Since there are no center cords, the Grommet belt is more flexible, and so can "give" temporarily and absorb shock loss. And there's no overlapping cord *section* as in all ordinary belts—no weak spots to cause premature belt failure.

Today's B. F. Goodrich V belts are the result of constant improvement, better processes for prestretching cords, for improving cord adhesion, for reducing internal heat and friction. You'll find B. F. Goodrich V belts at leading supply stores in the oil field, or at any one of these B. F. Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Oklahoma City, Tulsa, Dallas, Houston, Odessa, Wichita Falls. *The B. F. Goodrich Company, Dept. M-636, Akron 18, Ohio.*

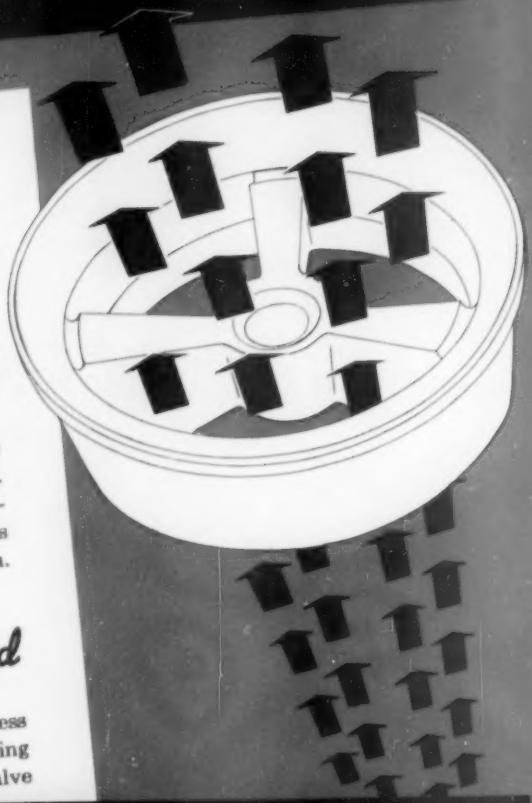
Grommet—T. M. The B. F. Goodrich Co.

B.F.Goodrich

INDUSTRIAL PRODUCTS DIVISION

"Oilwell" Valves and Seats have more fluid flow through the SEAT

...and every "Pusher" in the business knows what THAT means!



Pump Efficiency is Increased

. . . because large through-the-seat passage areas facilitate proper filling of the pump's fluid end on suction strokes. With the large, streamlined, open-type fluid passages provided in "Oilwell" and Wilson-Snyder slush pumps, this feature is essential if you are to have full-capacity operation.

Fluid Flow Velocity is Reduced

. . . by a corresponding degree. This, in turn results in less cutting action from abrasive particles in the fluid being pumped, achieving longer operating periods between valve replacement shut downs.

Because . . . of the many makes of slush pump valves and seats on the market today and because adequate fluid passage areas are so essential to smooth pump operations, we made comparisons between "Oilwell" and six other popular brands. NOT ONE equalled the "Oilwell" valve in flow area through the seat.

Try a set . . . of these new valves and seats in your "Oilwell" and Wilson-Snyder slush pumps and find out for yourself how they

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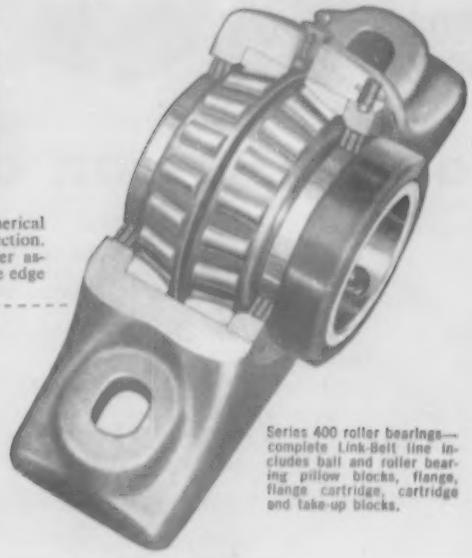
MORE FACTS on why more and more leading manufacturers choose Link-Belt bearings

EASY, LOW-COST INSTALLATION—Series 400 bearing blocks are quickly mounted on commercial shafting from ¾ to 4-in. diameters.

HEAVY COLLAR SECURELY LOCKS INNER RING TO SHAFT. Use of setscrews in collar avoids distortion of inner ring. Tension of collar against heavy setscrews assures tightness.

FREE ROLLING—SELF-ALIGNING. Spherical inner ring is free to align in any direction. Load is distributed over entire roller assuring full load capacity. Destructive edge loading cannot occur.

CONTACT-TYPE SEAL, left, of felt laminated with synthetic rubber for extremely dirty conditions. **LABYRINTH SEAL,** right, for normal conditions. Bearings are pre-lubricated and sealed at factory.



Series 400 roller bearings—complete Link-Belt line includes ball and roller bearing pillow blocks, flange, flange cartridge, cartridge and take-up blocks.

Fast, easy mounting

—a key feature of these self-aligning, high-capacity roller bearings

● Hundreds of equipment manufacturers who use roller bearings choose the popular, high-capacity Link-Belt Series 400. Compactness promotes neatness of machinery design . . . easy mounting reduces installation costs. And field service has developed an unmatched performance reputation because of many valuable features.

Series 400 pillow blocks are equipped with self-aligning, double-row roller bearings. Even under shaft deflection and misalignment, bearing maintains full load capacity during its long life.

This quality bearing is part of industry's most complete line of ball and roller bearing blocks—made at a Link-Belt plant devoted exclusively to these precision products. For Book 2550 on the full line—ask one of the 40 Link-Belt offices or any authorized stock-carrying distributor.

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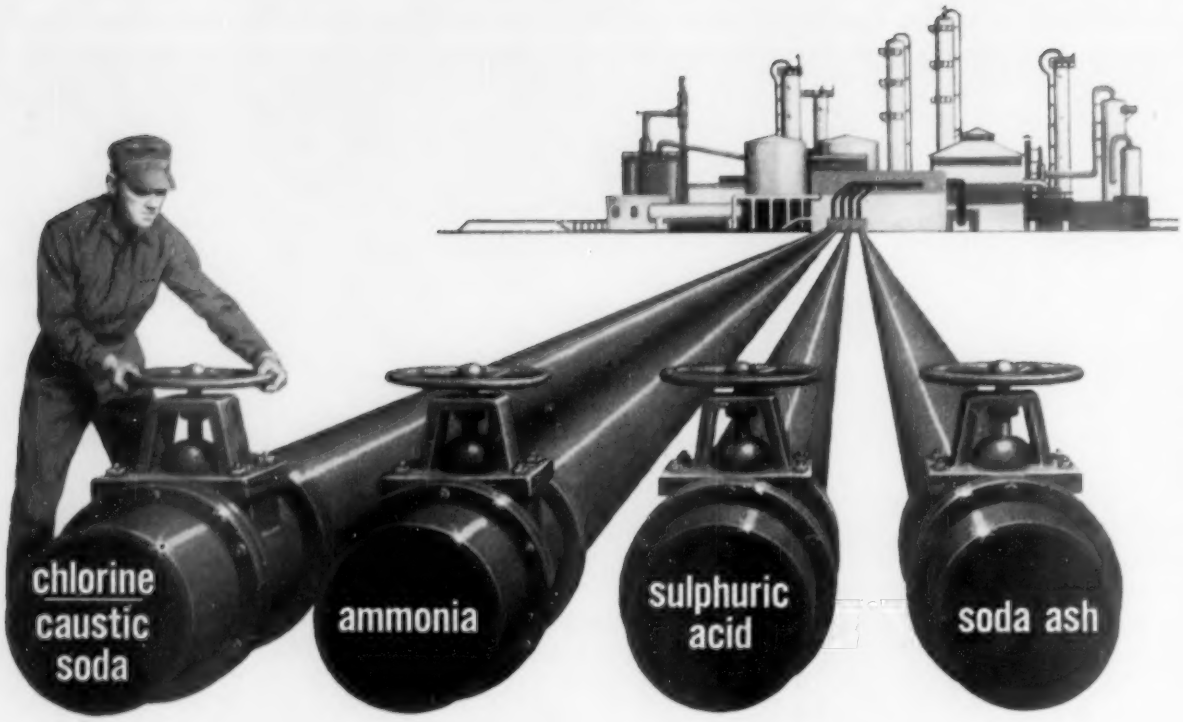

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Little Boomer—Oliver OC-3 and hydraulic side boom

OLIVER "Little Boomer" cuts pipelaying costs

Some operators use the Little Boomer to free bigger equipment for bigger jobs. Others substitute it for slow (and costly) hand labor.

Either way, the Little Boomer pays off.

Its capacity is surprising for a unit this size. Lifts 2000 pounds...carries 12-inch pipe in lengths up to 40 feet... lays and lowers pipe up to six inches in diameter. What's more, it's compact... easy to maneuver where larger rigs can't go...easy to transport on truck or trailer.

The OC-3 crawler with constant two-track power edges up to the ditch safely. Because the boom and line are both hydraulically controlled, it lowers pipe accurately and without jerking or jumping. Only two controls make operation simple.

Contact your Oliver Distributor. Ask about the low cost of your investment and the big returns you'll get from the Little Boomer—Oliver OC-3 and hydraulic side boom.

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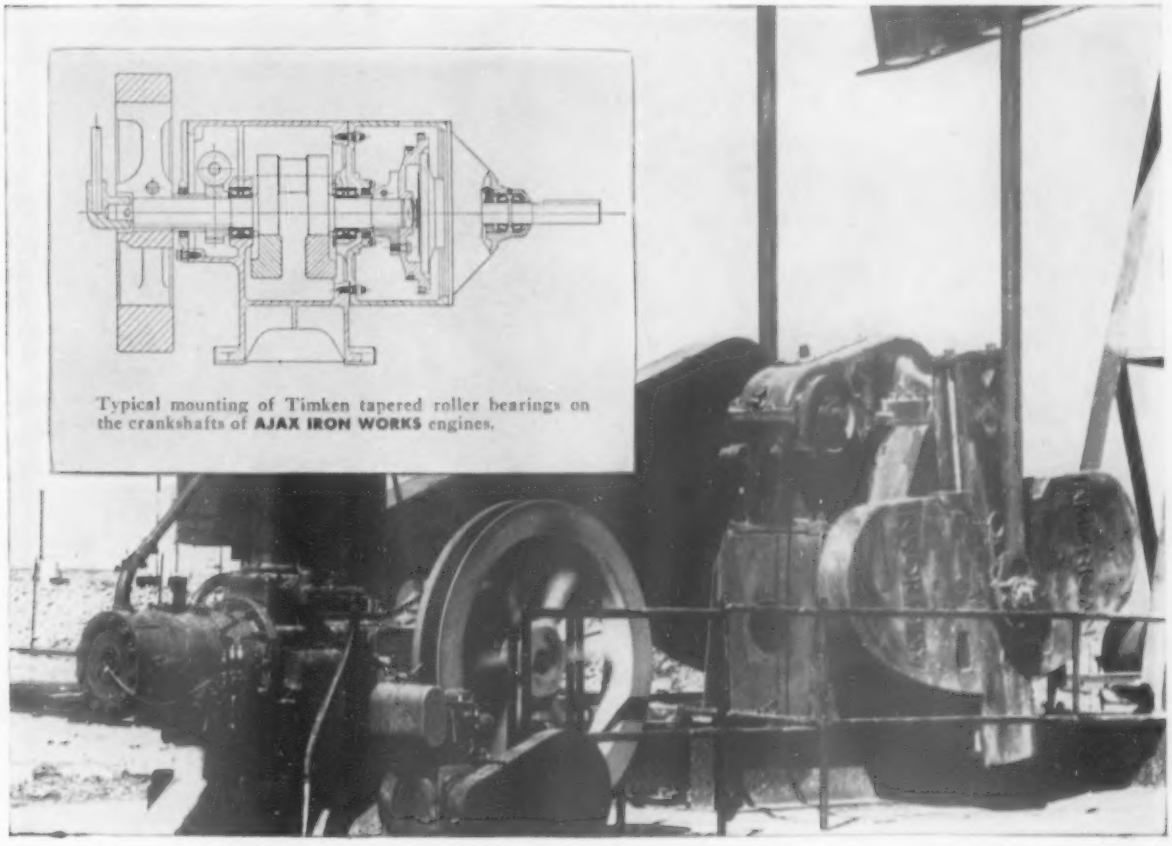
More horsepower, less maintenance

...crankshaft mounted on TIMKEN® bearings



Typical mounting of Timken tapered roller bearings on the crankshafts of **AJAX IRON WORKS** engines.

IMPROVED cylinder and piston design on Ajax Iron Works' heavy-duty DP-70 11 x 14 engine boosts horsepower 27%, at 350 rpm. Features include a direct drive rotary lubricator, rotary magneto, better counter-balancing, and power take-off type of clutch, and a crankshaft mounted on Timken® tapered roller bearings.

Timken bearings hold the crankshaft in correct alignment. Tapered construction lets Timken bearings take radial and thrust loads in all combinations. Geometrically designed to give true rolling motion, Timken bearings are precision-made to conform to their design. As a result, Timken bearings normally last the life of the engine.

As Ajax has learned through countless hours of trouble-free performance, Timken bearings permit virtually *unattended* engine operation. Full line contact between rollers and races means extra load-carrying capacity—and Timken bearings make closures more effective in sealing out dust, dirt and moisture, keeping lubricant in, by holding shafts and housings concentric. Maintenance is greatly reduced.

When you build or buy oil field machinery, look for the trade-mark "TIMKEN" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

TRADE-MARK REG. U. S. PAT. OFF.

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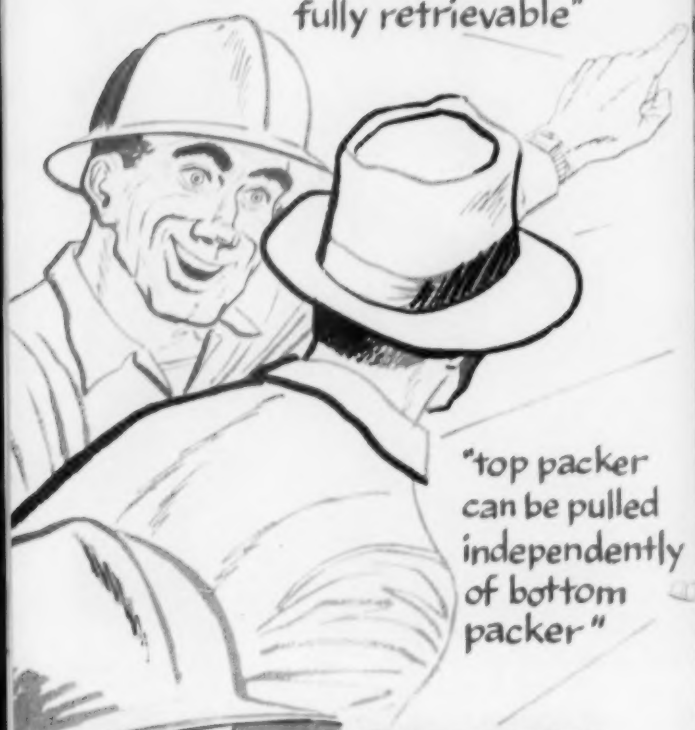
"both packers fully retrievable"



"top packer can be pulled independently of bottom packer"

BROWN RS-1

"the RS-1 can be run and set- then pull out of it, go back in & retrieve it"

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DUAL STRING PACKER

"runs both packers simultaneously"

"saves time- saves money!"

For further information, write: Brown Oil Tools, Inc.

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PEOPLE. The more than 300,000 people who own it—merchants . . . teachers . . . farmers . . . bus drivers . . . housewives . . . people who've invested their savings in our growth. They have just received the Annual Report on the 73rd year of our company's business.

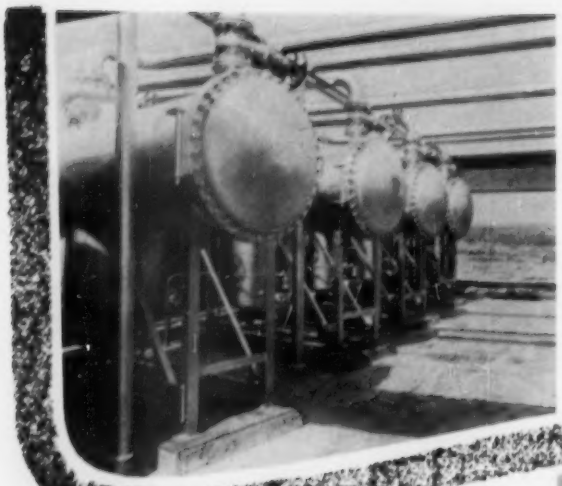
What makes Jersey Standard run? People. People in offices and in the labs, in the oil fields and refineries of our affiliated companies. People like all of us . . . who work, play, raise families.

What keeps Jersey Standard and its affiliates in business? All kinds of people — stockholders, employees and customers.

Because of all these people, we had a good year in '55. A year of searching for and finding more oil to provide light and heat, to run cars and trucks, trains and planes, buses and tractors, to make petrochemicals. A year of even greater research leading to more and better products. A year—as our Annual Report shows — of better sales and earnings, of record payments in wages and benefits to employees, of record income generated for governments in the form of taxes — a year, in short, of bigger contributions to the prosperity of the people of the countries where we do business.

If you would like a copy of our 1955 Annual Report to Stockholders, please write to us at: Room 1626, 30 Rockefeller Plaza, New York 20, N. Y.

STANDARD OIL COMPANY (NEW JERSEY) AND AFFILIATED COMPANIES



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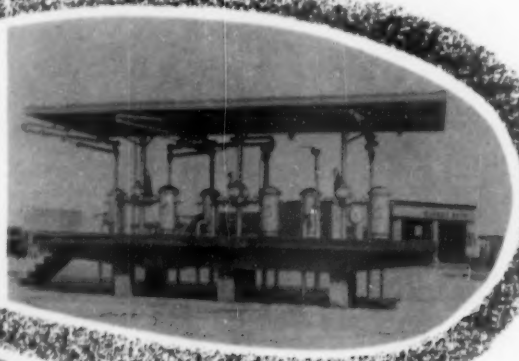
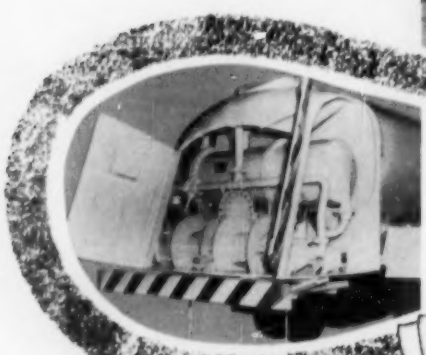
Warner Lewis Separators and Filters

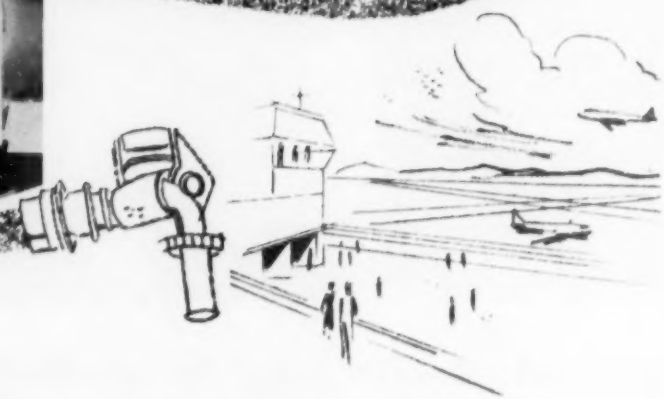


Warner Lewis Separators/filters . . .

. . . filters

. . . refueler separator/filters





WARNER LEWIS COMPANY

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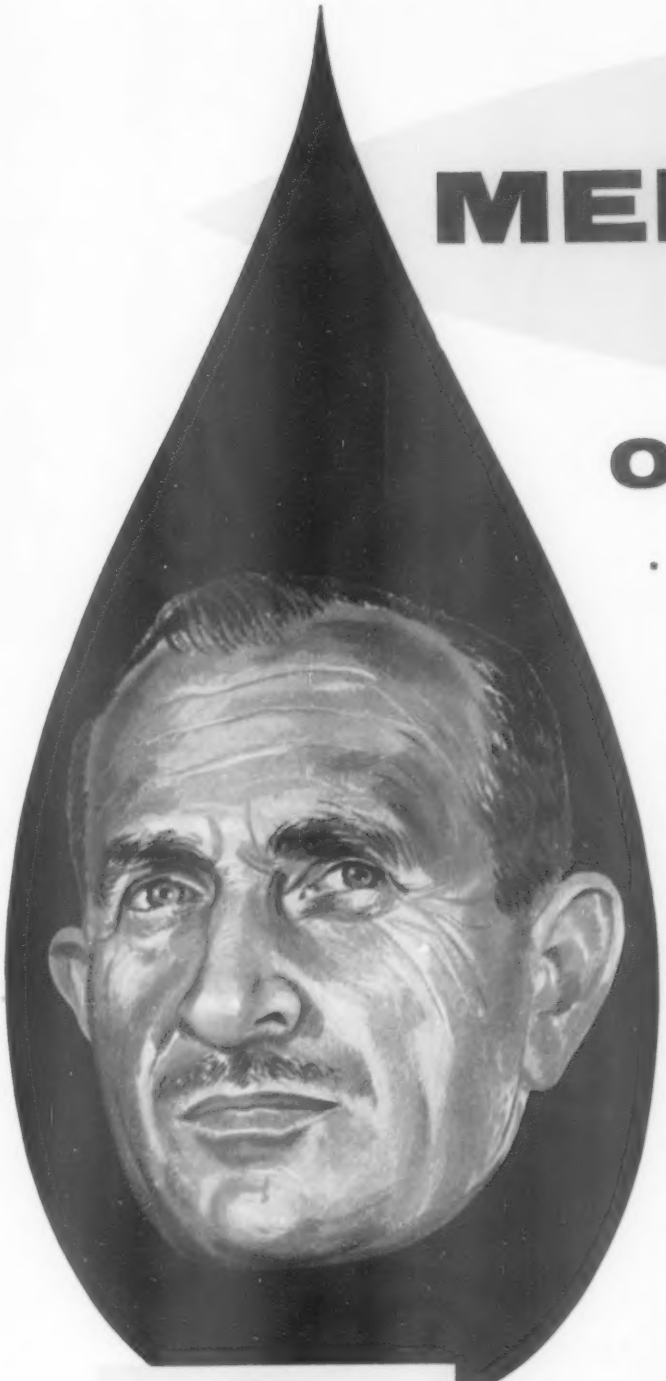
DIVISION OF
FRAM CORPORATION

. . . for turbo and jet fueling systems servicing todays modern aircraft

Warner Lewis separators and filters are being specified and installed nationwide on bulk fueling and tank truck applications. Newest designs meet current military specifications and most efficient operation plus easy servicing assures selection of Warner Lewis equipment.

Representatives In All Major Cities

Write for detailed information.



MEN make service!

O. O. DALE

...his middle name is Oil

His first name is Orie. His middle name *must* be Oil. Certainly, O. O. Dale has helped make history during his 30-odd years of work in the oil patch. Back in 1932, Orie helped set the record for the world's deepest oil well... at 10,900 feet. In 1937 he worked on the first wildcat to be completed solely on electric log information. 1940 found him engaged in the first bulk cement job in California at Greeley. In 1945 he introduced plastic plugging to California. He handled the first squeeze job ever to go over 4500 psi. Twenty of Orie's years of pioneering have been spent in the BJ Service, Inc., organization.

Orie and men like him have made BJ Service. Men with years of experience in working under all types of well conditions. Men who can find answers when problems arise. Men you can depend on to get the results you want.

BJ Service brings you the finest equipment, the newest materials, the latest in researched techniques for oil well services. But BJ Service's real strength lies in men like Orie Dale who do the job as only they know how to do it, who work long hours without rest to complete it, who head for the yard after it's all over secure in the knowledge that the job has been done right.

Call for this experienced, around-the-clock service on your next cementing, well-stimulation or wire line job. Call for the men who make service... BJ Service, Inc.

BJ Service

BJ SERVICE, INC.

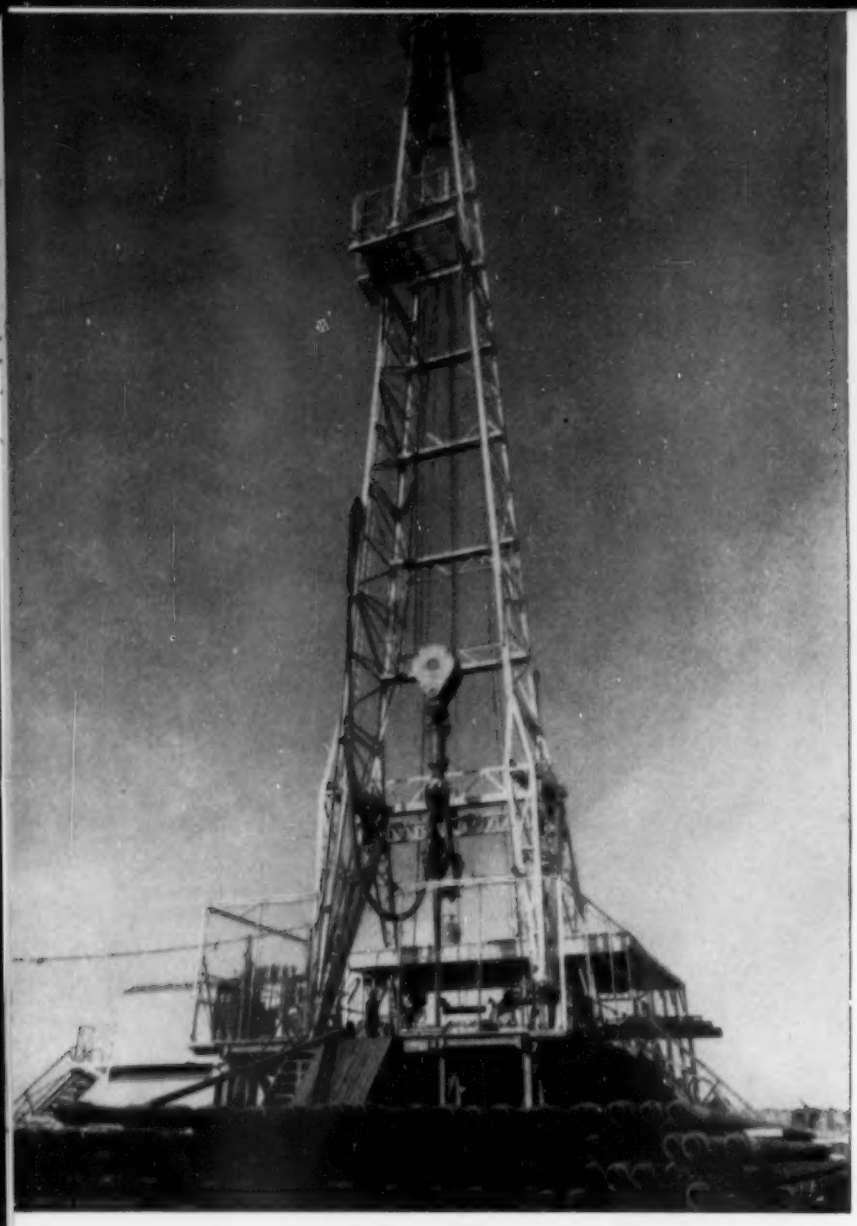
A SUBSIDIARY OF BORG-WARNER CORPORATION

GENERAL OFFICES:

6505 Paramount Boulevard • Long Beach 5, California

Los Angeles Phone: NEvada 6-2493 • Long Beach Phone: GArfield 3-1411

Service stations throughout the Pacific Coast, Rocky Mountain and Permian Basin areas



Designed for speed in drilling, this rig drilled 7,400 ft in 16 days at a location near Lindsay, Oklahoma. Carrying 40,000 lb of weight at the bit, it was pumping 641 gallons of mud a minute at 1,800 lb pump pressure to pulverize sand and rock and increase the drill's boring speed.

Power-Play For Oil

Mercury Drilling Company—searching for new reserves —uses one of the most powerful rigs ever built to thrust Pittsburgh Steel Company drill pipe into the earth.

Packing all the controlled power of a diesel locomotive, Mercury Drilling Company's Rig No. 2 is a giant among the nation's rotary drill rigs. This herculean rig, with its 142-ft high derrick now working in the oil-laden Golden Trend sands of Oklahoma, can bore its jet bits into the earth at rates up to 1,000 ft a day. It can bullseye a one-foot diameter target more than three miles underground.

Roughnecks stab the tool joint into the waiting end as another length of drill pipe goes into the hole.

Equipped with three 870 hp engines and three of the largest torque converters built, it can supply more than 2,400 hp to drive the rotary table and mud pumps. Its block, weighing nearly 8 tons, was specially designed for the rig.

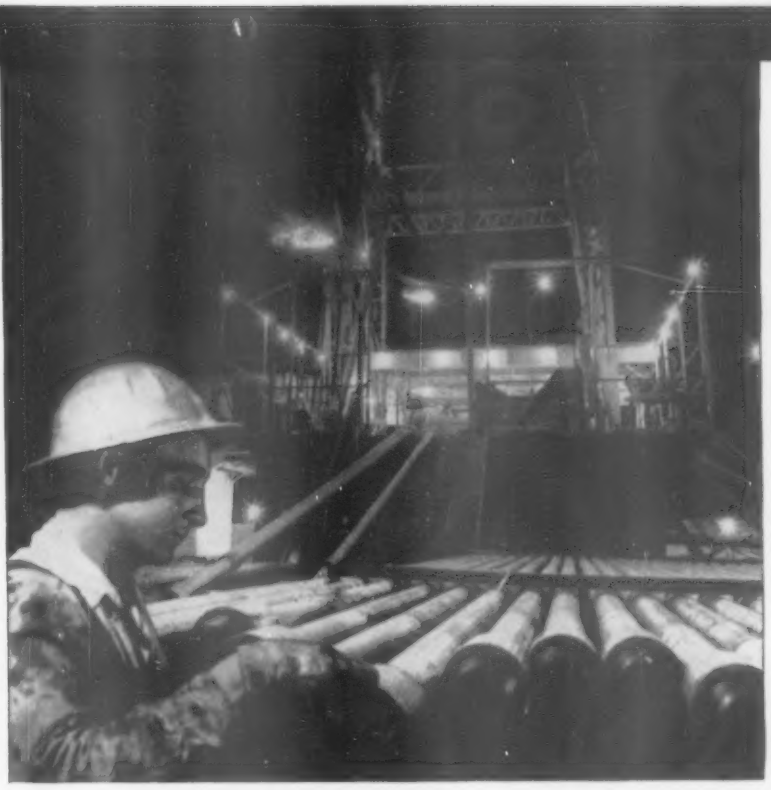
Compact design throughout and a portable mud tank system give the rig mobility. On completing a hole, it can be knocked down, transported to a new location, set up and be drilling again in less than 2½ days with favorable weather.

When you have an investment of over a half-million dollars and operation costs up to $1,000 a day on a rig such as this, you can't afford to waste time.

Every feature of Mercury No. 2 is built for speed. From the power needed to carry heavy bit weight-loads, to the automatic slips for going in and out of the hole, it is equipped to drill more footage faster and more efficiently. Its mobility reduces down time between jobs.

Quality of the equipment and swift supply service are also essential to reaching pay fast. Here again Mercury saves time and expense.

This rig with all its equipment —including Pittsburgh Steel Company's seamless 4½ in. OD



Drill pipe, being measured in the rack, is fed into the hole length by length as the hole deepens. On a rig such as this it must withstand severe tension, compression, torsion and fatigue stresses as well as abrasive wear.

Grade E Range 2 drill pipe—is supplied by one of the independent distributors listed at right. Already a pace setter, it is hungrily churning after new footage records.

When operations must move fast, oil men with a lot at stake prefer the services of these distributors. Here's why:

Independent distributors are ready for action. Even the smallest item of equipment is available to your rig 24 hours a day, seven days a week. Well-stocked supply stores mean equipment can be on hand at the rig with least delay. You can count on them in emergencies.

Their service is flexible. The independents are personal friends to oil men they serve. Through long experience, they know the problems and can meet requirements without red tape and extra paper work. They are free from remote control and can make big decisions without wasting time.

Independent distributors help keep costs low. With all the extra service available, they keep their prices competitive. They can do this because of low overhead, and because their livelihood depends on meeting competition. The return Mr. Independent makes in business stays at home.

Their equipment is the best. Being independent, these distributors are free to select from the best equipment made, on the basis of performance and customers' requirements. They are backed by reputable manufacturers—such as Pittsburgh Steel Company, a producer of high quality seamless oil country goods for more than half a century.

Independents are accessible. The distributors at right have 141 stores covering all major oil fields in this country and some abroad. Yet each distributor individually concentrates his services in the home areas he is best qualified to serve.

Next time you need a string of drill pipe, casing or tubing, get the pipe of your choice through the distributor of your choice! Specify Pittsburgh Seamless!

For Fast, Personal Service

—these independent distributors who carry Pittsburgh Seamless drill pipe, oil well tubing, and casing are ready to meet your requirements.

Home Offices

Bradford Supply Company
130 Main Street
Bradford, Pennsylvania

Buckeye Supply Company
18 Harrison Street
Zanesville, Ohio

C. W. Cotton Supply Company
Utica National Bank Building
Tulsa 5, Oklahoma

Franklin Supply Company
624 South Michigan Avenue
Chicago 5, Illinois

Houston Oil Field Material Co.
1524 Maury Street
Houston, Texas

Industrial Supply Company
500 Eighth Street
Wichita Falls, Texas

Iverson Supply Company
400 West Fifth Street
Tulsa, Oklahoma

Lucey Export Corporation
233 Broadway
New York 7, New York

Lucey Products Corporation
624 South Cheyenne
Tulsa 19, Oklahoma

McJunkin Corporation
P. O. Box 513
Charleston 22, West Virginia

Midland Supply Company
Box 3105
Washington St. Station
Wichita 7, Kansas

Mountain Iron & Supply Co.
100 Rule Building
Wichita 2, Kansas

Murray Brooks, Incorporated
P. O. Box 855
Lake Charles, Louisiana

Producers Supply & Tool Co.
706 Commercial Standard Bldg.
Fort Worth 2, Texas

Rodman Supply Company
P. O. Box 2752
Odessa, Texas

Southwest Supply Company
1720 Oliver Building
Pittsburgh, Pennsylvania

Superior Iron Works & Supply Co.
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District Sales Offices

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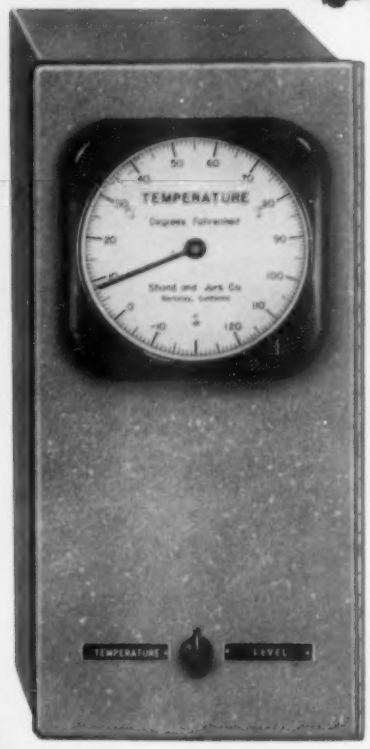
Chicago	Dallas	Houston	Philadelphia	Warren, Ohio
Cleveland	Dayton	Los Angeles	Pittsburgh	

NOW — S&J ADDS TEMPERATURE TO TELEPULSE

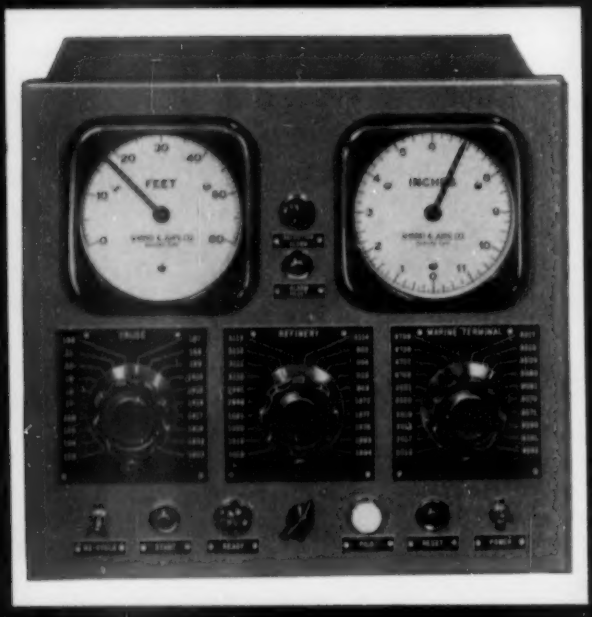
S. & J. Engineers have perfected a Telepulse Temperature System by which temperature readings may be taken of petroleum storage in distant tanks, either spot temperatures at given points of a tank, or an average temperature reading at any given liquid level.

Those who now use the famous S. & J. Telepulse Remote Reading Gaging System may add the Telepulse Temperature System as an independent auxiliary. Those not interested in level determinations may utilize the Telepulse Temperature System in obtaining remote temperature readings only.

The New Telepulse Temperature System is illustrated and described in Bulletin TT-456, while the Telepulse Remote Reading Gaging System is covered in Bulletin T-455. Please write for a copy of either or both bulletins if you are seriously interested in Remote Readings of levels or temperatures.



Above, the Telepulse Temperature Indicator, encased in a steel cabinet finished in crackle grey and of dimensions to mate perfectly with the Telepulse Level Reading Unit in size and finish, so that both may be installed side by side in an instrument panel.



The illustration at the left shows the Telepulse Remote Reading Gaging System, which gives accurate tank gage readings of distant storage in feet, inches and eighths of inches.

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CALGARY: P. D. McLaren & Son, Ltd., 310 - 9th Ave. W.
MEXICO, D.F.: Dolmar Comercial, S. A.
CARACAS: Sinclair Spence, C.A., Edificio Galipan
ENGLAND: Whessoe, Ltd., Sales: 25 Victoria St., London S. W. 1
Whessoe Ltd., Works: Darlington, County Durham

$160,000 saved

IN ONE AREA ALONE

with HALLIBURTON'S

ROTO WALL CLEANERS

An 18-month survey of 423 wells in one field proved conclusively the immense value of Halliburton's Roto Wall Cleaners.

In 192 of these wells, oil strings were cemented without using Roto Wall Cleaners, and squeeze jobs were later required in 111 of them. But – in the other 231 wells the bore walls were prepared with Roto Wall Cleaners and only 38 required squeeze jobs. This 72% reduction in squeeze cementing jobs meant a saving to owners conservatively estimated at $160,000!

LESS CEMENT CHANNELING AFTER ROTO-WALL JOBS

Rotary action of Roto Wall Cleaners can result in such savings because they:

- *Decrease bridging hazard—permit free flow of fluid in annulus.*
- *Reduce lost circulation problems—no damaging pressure surges caused by reciprocating scratching movements of casing.*
- *Minimize disturbance of filter cake when running into hole. No filter cake removed until casing is rotated.*
- *Casing remains at casing point—lessens danger of sticking "off bottom."*
- *Cement sets in clean, horizontally grooved, laminated rings that give a stronger, more durable bond—reducing vertical channeling and fluid migration.*

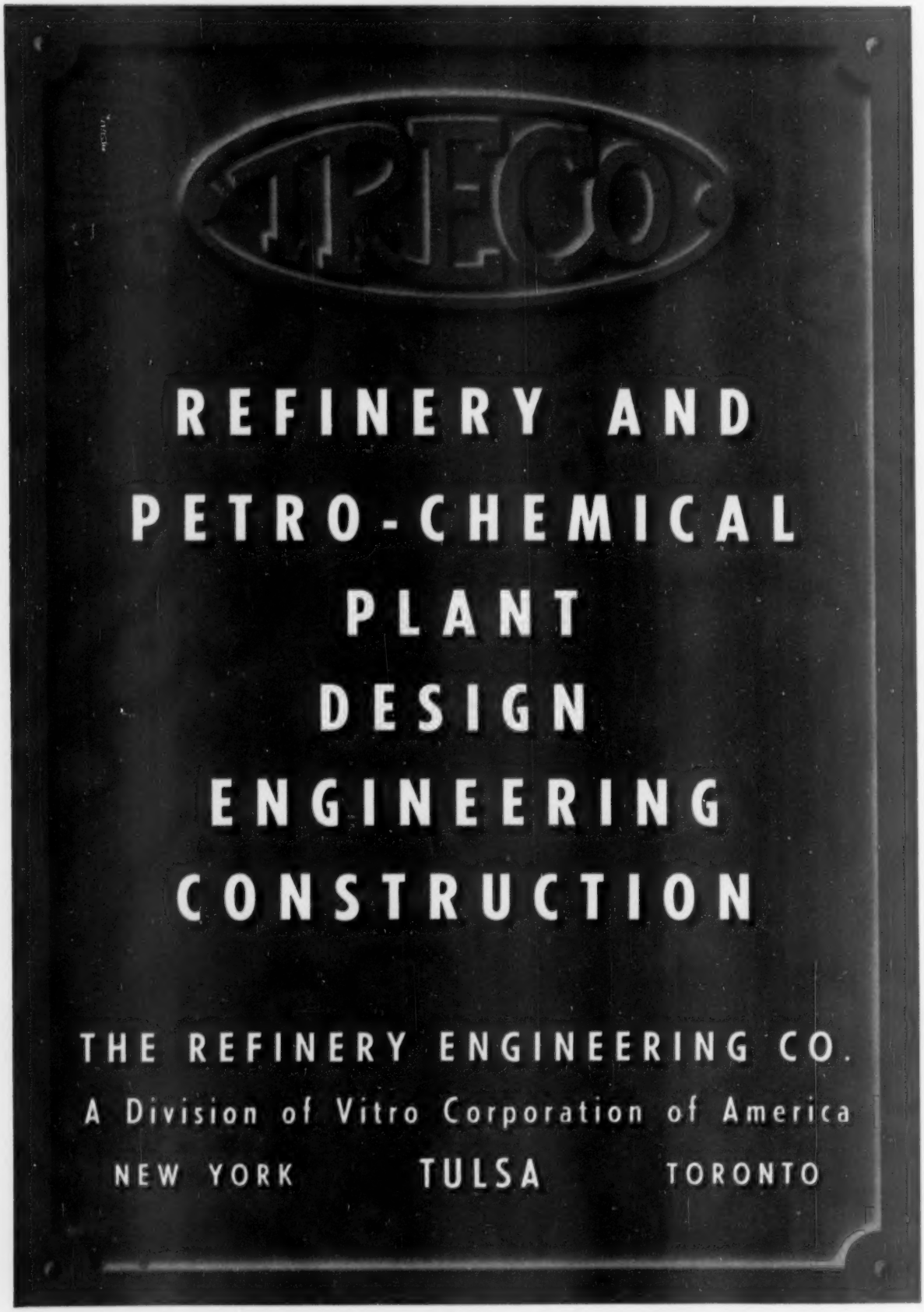
Reduce squeeze cementing costs with the aid of the one wall cleaner backed by Halliburton's three million job experience and 30 years of research. Call your local or district office of the Halliburton Oil Well Cementing Company.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File

HALLIBURTON CEMENTING SERVICES

250 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG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NEW YORK
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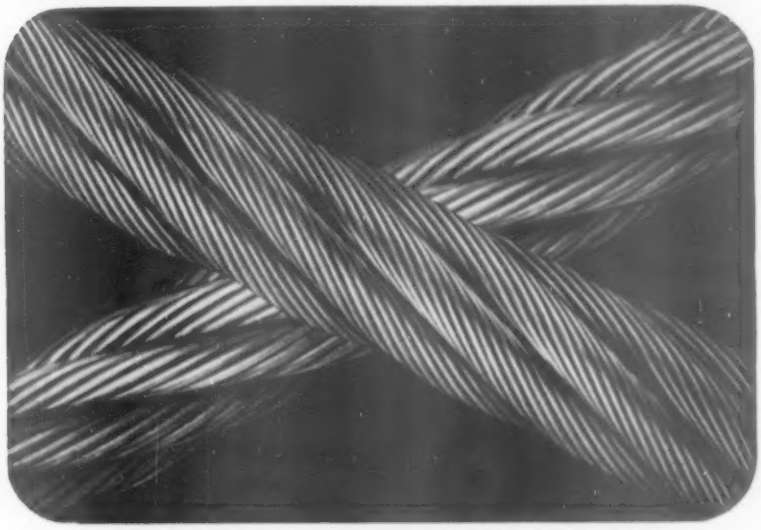
FIRST WE DEVELOPED 1105 ROPE WIRE.



THEN WE MADE ROEBLING'S

Royal Blue

WIRE **1105** ROPE

1105 takes Royal Blue out of the ordinary wire rope class.

1105 is a rope wire that's new—that's stronger. It's the biggest news in many years.

1105 is the result of more than a century of research and development—it's the wire that gives Roebling Royal Blue the stamina that pays off in service.

Contact your Roebling distributor or write us for the full story.

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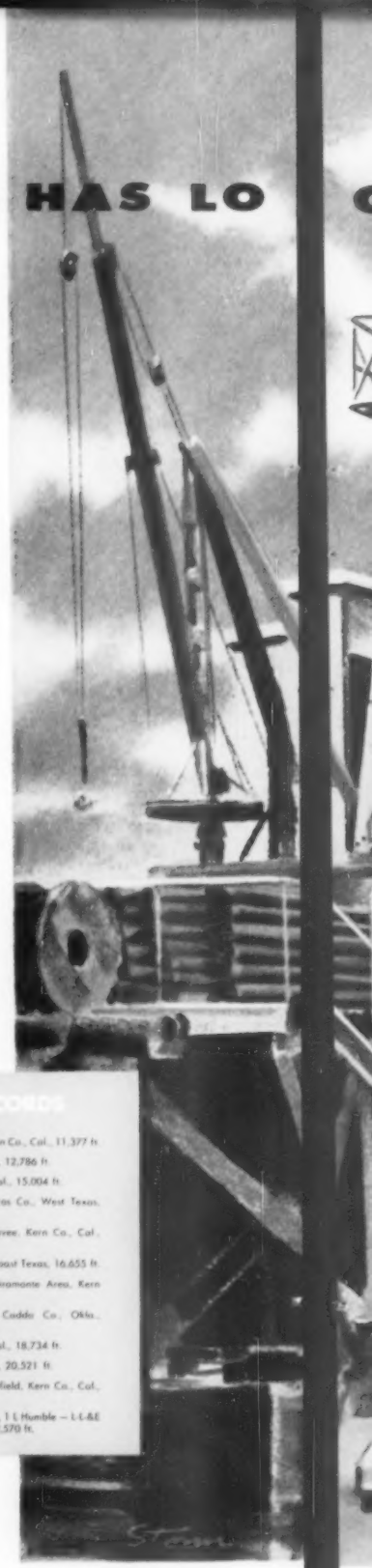
Subsidiary of The Colorado Fuel and Iron Corporation

CFI

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4501 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

SINCE 1934 SCHLUMBERGER HAS LO



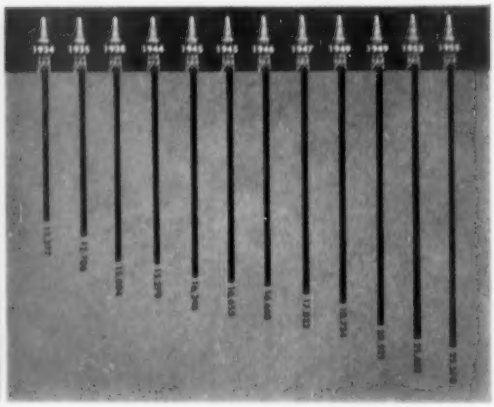
Schlumberger is proud to have been assigned the responsibility of surveying the Richardson-Bass, John Mecom, Freeport Sulphur record depth well. And with this well . . . on the edge of Lake Washington in Plaquemines Parish, Louisiana . . . Schlumberger maintained its own record of having surveyed every record depth well since 1934 when 11,137 was achieved.

Working at bottom hole temperatures of 340 degrees and with 24,000 feet of cable, the Schlumberger crew completed the record Electrical Survey without mishap or delay in only 2½ hours. Everything worked like a routine survey.

Schlumberger has been first, time after time, to encounter and solve new problems common to greater depths and unknown bottom hole conditions. The unparalleled experience which Schlumberger has gained in surveying every record well is reflected in the Schlumberger quality which you receive on every survey, regardless of depth.

How deep will drilling eventually go? No one knows. But in the future, as in the past, Schlumberger will have the equipment and techniques proved and ready to provide well services to any depth oil operators drill.

here's the box score



DRILLING DEPTH RECORDS

1934 – General Petroleum Corp.'s Berry 1, Belridge, Kern Co., Cal., 11,377 ft.

1935 – Gulf Oil's McElroy 103, Upton Co., West Texas, 12,786 ft.

1938 – Continental Oil's KCL A-2, Wasco, Kern Co., Cal., 15,004 ft.

1944 – Phillips Petroleum's Ada Price 1, Wildcat, Pecos Co., West Texas, 15,279 ft.

1944 – Standard of Cal.'s KCL 20-13, South Coles Levee, Kern Co., Cal., 16,246 ft.

1945 – Phillips' Schoops 3, Wildcat, Brazos Co., Gulf Coast Texas, 16,655 ft.

1946 – Pacific Western Oil's National Royalties 1, Miramonte Area, Kern Co., Cal., 16,668 ft.

1947 – Superior of Cal.'s Weller 51-11, Wildcat, Caddo Co., Okla., 17,823 ft.

1949 – Superior-Limonaria 1, Wildcat, Ventura Co., Cal., 18,734 ft.

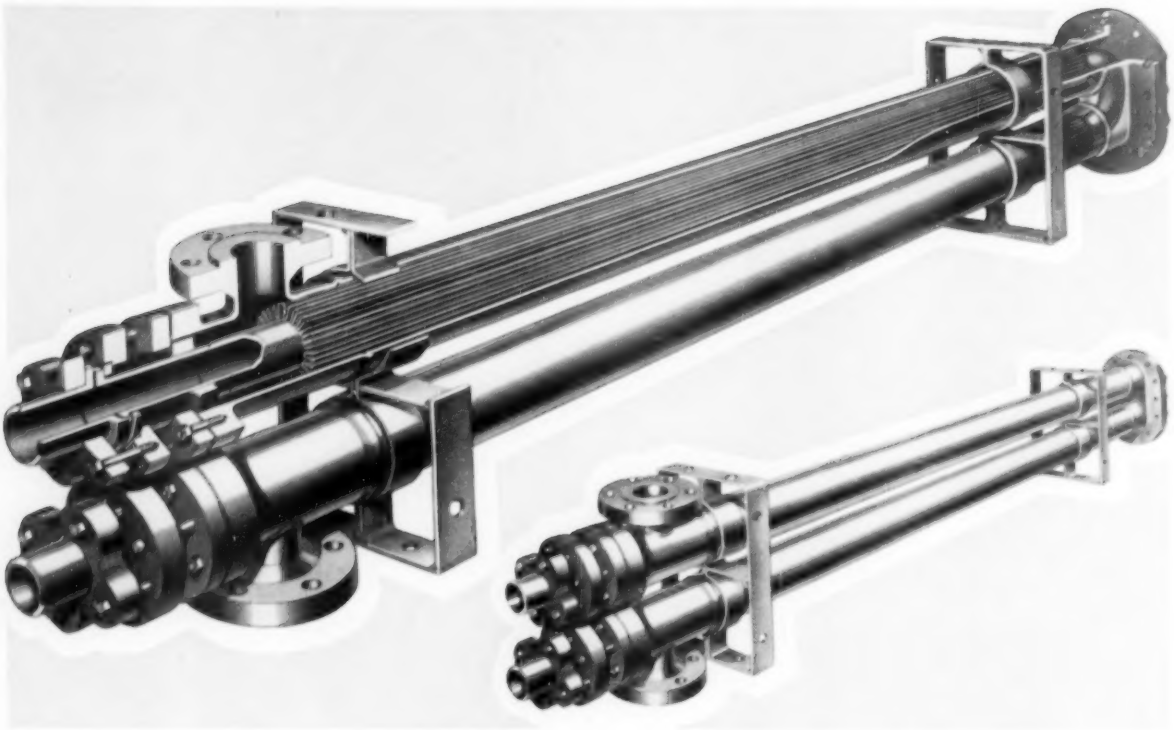
1949 – Superior, Unit 1, Wildcat, Sublette Co., Wyo., 20,521 ft.

1953 – Ohio Oil's Kern Co. Lands "A", 72-A, Paloma field, Kern Co., Cal., 21,482 ft.

1956 – Richardson-Bass, John Mecom, Freeport Sulphur, 1 L Humble – L-L&E – State Lease 2414, Plaquemines Parish, La., 22,570 ft.

SCHLUMBERGER
WELL SURVEYING CORPORATION
THE EYES OF THE OIL INDUSTRY

Richardson-Bass, John Mecom, Freeport Sulphur, 1 L Humble — L-L-&E — State Lease 2414, Plaquemines Parish, La., 22,570 ft.



NEW ALCOTWIN HEAT EXCHANGERS GIVE "BUILDING BLOCK" FLEXIBILITY, UNEQUALLED HEAT TRANSFER

ALCOTWIN heat exchangers provide economical, high performance in package form. Their double-pipe fin tubes, with a high ratio of extended surface, make them particularly adapted to water-cooled or vapor-heated services.

Easily arranged and supplemented, ALCOTWINS readily meet changing load and process requirements. Unlike conventional shell-and-tube heat exchangers, they never become obsolete.

Standardized design of the ALCOTWIN allows custom selection of metallurgy for specific service, with the economy and availability provided by "off the shelf" standard parts.

Complete data is available from any of ALCO'S sales offices. Or write P. O. Box 1065, Schenectady 1, N. Y., for brochure.

ALCO LONGITUDINAL FIN TUBES

Unequalled heat-transfer characteristics result from the fused metal-to-metal bond between the "U" shaped fin channels and the tube. ALCO's heliarc welding techniques provide a continuous, even bond resulting in higher efficiency.

ALCO

ALCO PRODUCTS, INC.

New York

Sales Offices in Principal Cities

Bulkplants and dealers find that cylinders, like these, eliminate high pressure loss because a coat of aluminum paint reflects heat, reduces expansion in the cylinder.

LP-Gas Cylinders, filled and supplied by Sungas Products Corporation, Monticello, New York, are spray-painted with one coat of durable aluminum enamel, manufactured by **Processed Chemical & Coatings Corp.**, Brooklyn 11, N. Y.

LP-PROLUME Aluminum Enamel reflects solar heat, controls gas expansion in SUNGAS cylinders

TANKS HOLD MORE GAS, REQUIRE LESS REFILLING

Sungas Products Corporation has found the ideal coating for its complete line of LP-Gas Cylinders—it's LP-PROLUME Aluminum Enamel, pigmented with ALCOA® Aluminum. Sungas likes aluminum paint because only one easy-to-apply coat is needed to give the tanks a durable, corrosion-resistant finish. This durability is essential for tanks constantly exposed to severe weather and atmospheric conditions.

Most important, Sungas reports that aluminum paint reflects solar heat which keeps gas expansion in the tanks to a minimum. Thus, tank pressures do not build up to the pressure relief point during hot weather, saving money for dealers and customers.

The LP-Gas Cylinder Finishes Division of PROCESSED CHEMICAL & COATINGS CORP., also manufactures a complete line of "9" protective coatings for the LP-Gas Industry. LP-Cyluminum, -Syntalum, -Synchrome, -Chrome and 4847 Bulk Tank Enamel, all brilliant enamels pigmented with ALCOA Aluminum, are standard with a great number of bulkplants throughout the country.

ALCOA does not make paint, but ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Special formulas have been developed by your paint manufacturer to solve individual problems. Paints made to these formulas actually cost less, last longer, give utmost protection against heat, cold, sun, rain, smoke and fumes.

You should have the latest information on aluminum paints and aluminum roof coatings. Write today for our two FREE booklets, *Painting With Aluminum* and *Aluminum Asphalt Roof Coatings Make Time Stand Still.* Use the coupon.

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TELEVISION'S FINEST LIVE DRAMA
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Wherever Strength,

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you'll find

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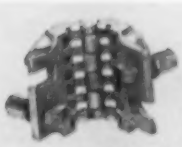


D+B QUIK-GRIP® ROD CLAMP

—for one-man installation

Eliminates "knuckle busting." Easy, quick opening is provided by a quarter turn of Tee-head permitting special forged bolt to slide through slot to remove clamp. Meets API specifications for pulling load.

D+B DUAL-PAC® STUFFING BOX

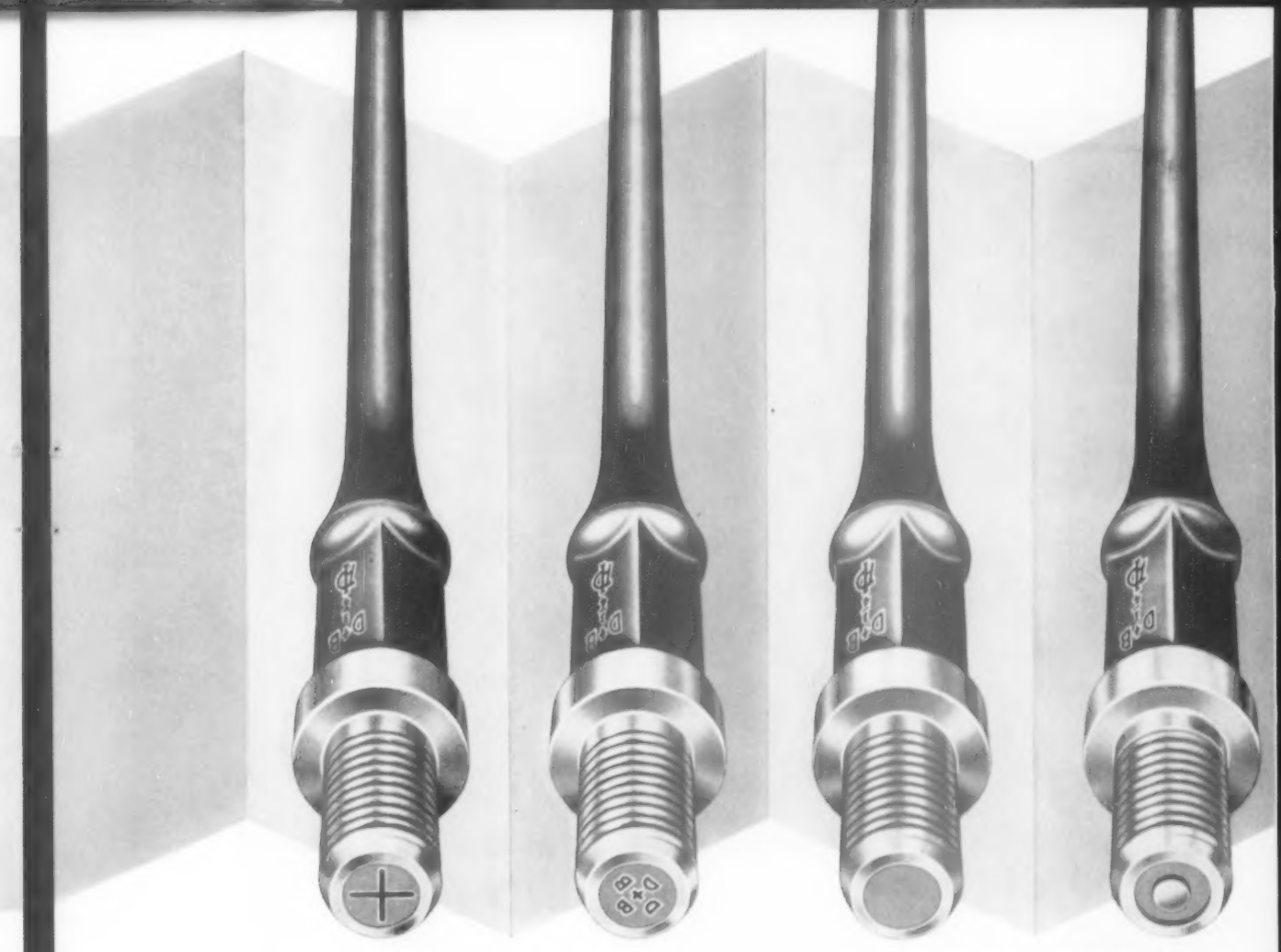
—a major time saver

Use of dual packing permits replacing the pressure seal packing easily without killing the well. Due to superior design, the higher the well pressure, the tighter the seal. Exceptionally wear resistant.

D+B API PONY RODS

—available in all diameters

in lengths of 2, 4, 6, 8, 10 and 12 feet and correspond to each sucker rod type. Made from metallurgically controlled steel, D+B API Pony Rods are full length normalized and drawn.



RODS

Made from special nickel-chromium, medium carbon manganese, nickel molybdenum or electric furnace high alloy steels, D + B Sucker Rods are favorites everywhere for heavy and medium pumping duty in severe, medium and ordinary corrosive wells.

Built by master craftsmen in the world's most modern sucker rod factory and backed by 50 years of know-how, D + B Sucker Rods combine strength, ductility and impact resistance. You get more for your money when you select them from complete stocks at the nearest CONTINENTAL or D + B store.

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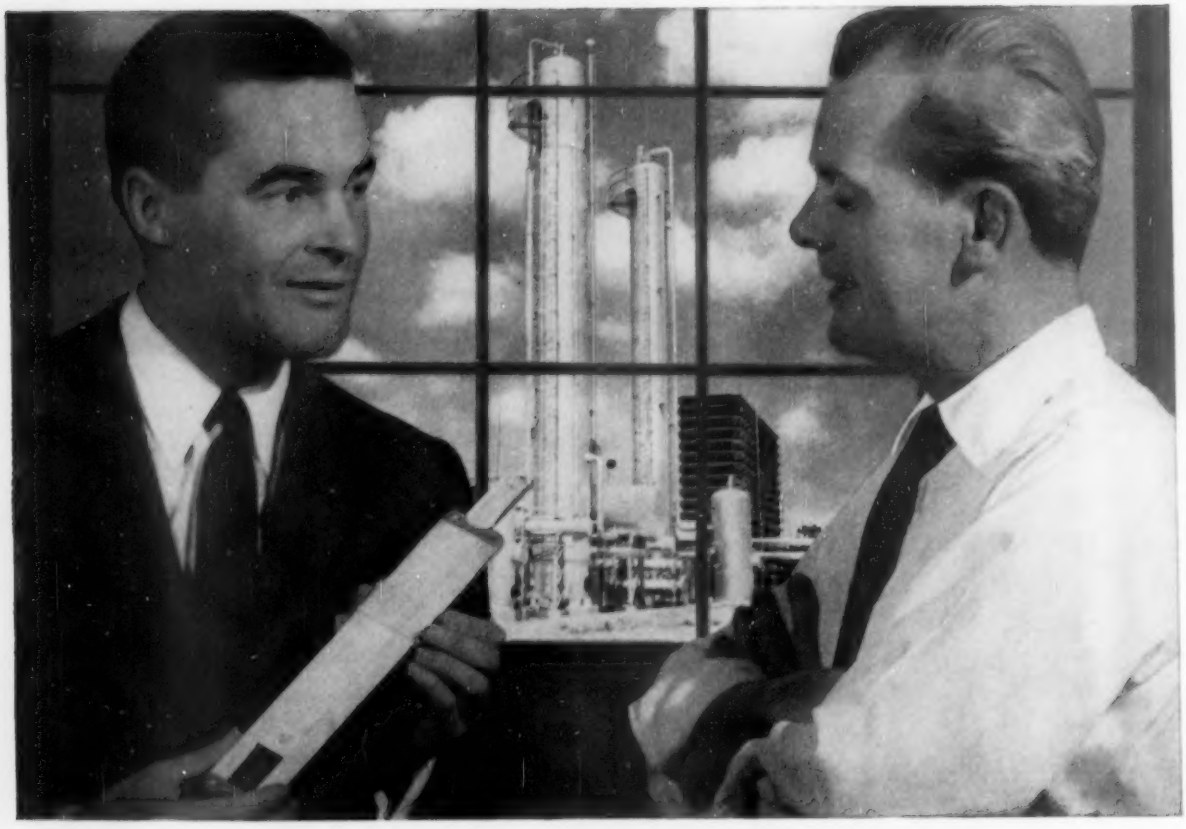

You get more than gas treating chemicals from CARBIDE...

CARBIDE's mono- or diethanolamine give you excellent removal of CO_2 and H_2S. By converting the extracted H_2S to sulfur or H_2SO_4, you benefit by recovering a valuable product—thus reducing your operating costs.

CARBIDE's di- or triethylene glycol remove H_2O economically from gas streams. The low initial investment and low operating costs of glycol type plants provide minimum dehydration charges.

Plus Benefits

- Technical data gathered from 22 years experience producing and supplying gas treating chemicals. These data can help you in construction of new facilities, the enlargement of present equipment and in securing trouble free performance of existing plants.
- Technical help from field representatives and service laboratories.
- Fast delivery from warehouses located near major gas fields.
- Constant source of supply.

Find out for yourself how CARBIDE can help you. Write today to Carbide and Carbon Chemicals Company, Room 308, Department H, 30 East 42nd Street, New York 17, New York.

In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal. In Western Canada: Harrisons and Crossfield.

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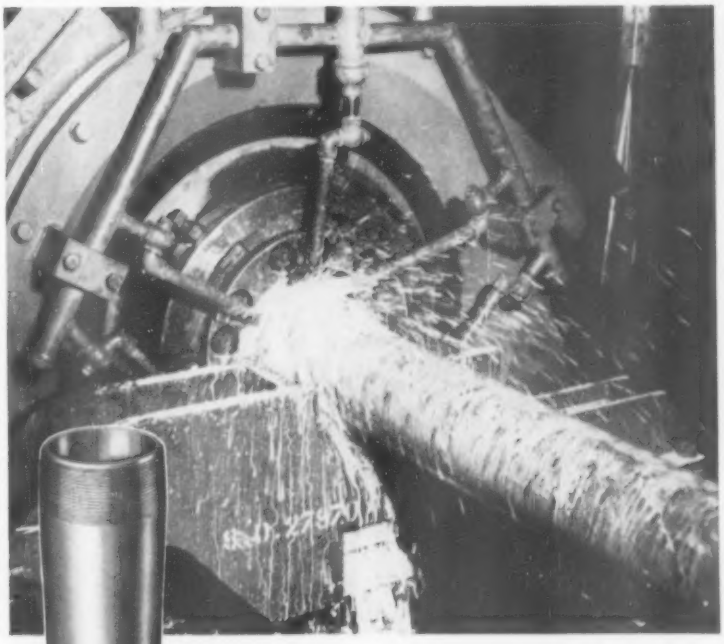
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street New York 17, N. Y.

CF&I SEAMLESS CASING AND TUBING



extra care for extra dependability

You can rely on CF&I Seamless Oil Country Casing and Tubing for positive dependability because it's made with extra care—care which exceeds that required by API Specification 5A.

Typical of these extra safeguards is the treatment that's given every steel billet used in the manufacture of CF&I Casing and Tubing. Because experience has shown that tiny flaws sometime lie just below the outer surface of steel billets, CF&I removes ⅛ of an inch of this questionable metal. Giant peelers (lathes) shave each billet down to a solid core...and, with this discarded metal, go flaws which might otherwise go undetected.

This is just one of the extra precautions that CF&I takes to provide you with seamless casing and tubing of the highest quality.

Fully meeting API STD 5A specification, CF&I Oil Country Casing and Tubing are available in sizes from 2⅜" through 9⅝" O.D.

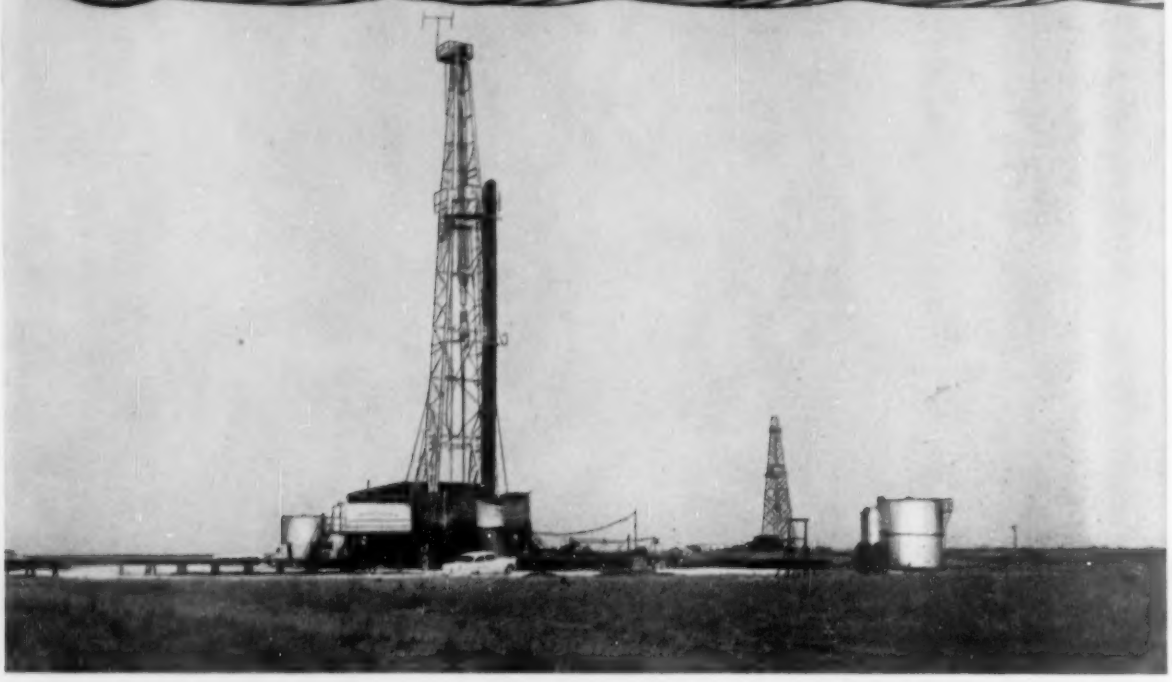
3893

SEAMLESS TUBULAR PRODUCTS
THE COLORADO FUEL AND IRON CORPORATION
Denver, Colorado

CF&I

an ACCO product

American Cable TRU-LAY VHS 15% STRONGER



Higher Safety Factor, Faster Drilling with New VHS Rotary Drilling Lines

More and more operators are learning of the many advantages of new VHS rotary drilling lines. Made from a new grade of steel for Wire Rope, they are 15% stronger than Improved Plow Steel lines, the strongest grade available before VHS was introduced.

Higher Factor of Safety

Obviously this means a higher safety factor. For example, 10 lines of VHS have a factor of safety 15% higher than 10 lines of Improved Plow Steel. In fact, 10 lines of VHS have a factor of safety equal to 12 lines of Improved Plow Steel.

Less Down Time, Faster Drilling

You can drill deeper before increasing the number of parts of line with new VHS. You can make round trips faster. And VHS' extra strength eliminates, in many cases, any necessity for regrooving sheaves or buying new blocks to use larger diameter lines for higher safety factors.

Tougher

New VHS is tougher, too. Its extra strength and toughness give it greater resistance to abrasion and higher resistance to peening . . . both important factors in maintaining diameter and shape. If regular adaptable cut-off practices are followed, ton-mile advantages should result.

Now in Winch Lines

Your nearest Mid-Continent Supply Store has Rotary Drilling Lines of new VHS in stock now. He now also has Winch Lines of this new, stronger, tougher Wire Rope. Call him today. No complicated specifications needed—just tell him the size and diameter you want.

For further information write to the nearest American Chain & Cable Company office listed below for Brochure DH-516H

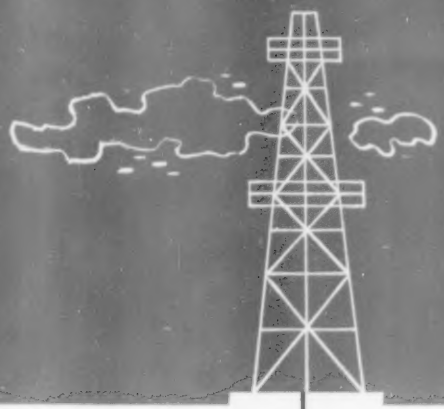
ACCO

TRADE MARK

American Cable Division
AMERICAN CHAIN & CABLE

630 McFarland St., Houston 1, Texas | 4555 E. 46th Ave., Denver 16, Colorado | 2216 S. Garfield Ave., Los Angeles 22, Calif. | 400 W. Madison St., Chicago 6, Ill.

Wilkes-Barre, Pa.; Odessa, Texas; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.



$50,000.00 hangs by a thread!

Fifty thousand dollars worth of drill pipe, tool joints, and drill collars!

Technically, not just one thread, but—in the American Iron Straight Grip—a combination of precision-engineered threads and shrink seals which make the most efficient shrink type tool joint in operation today!

Tests have proven that STRAIGHT GRIP tool joints are 3 times as strong as the pipe they connect!

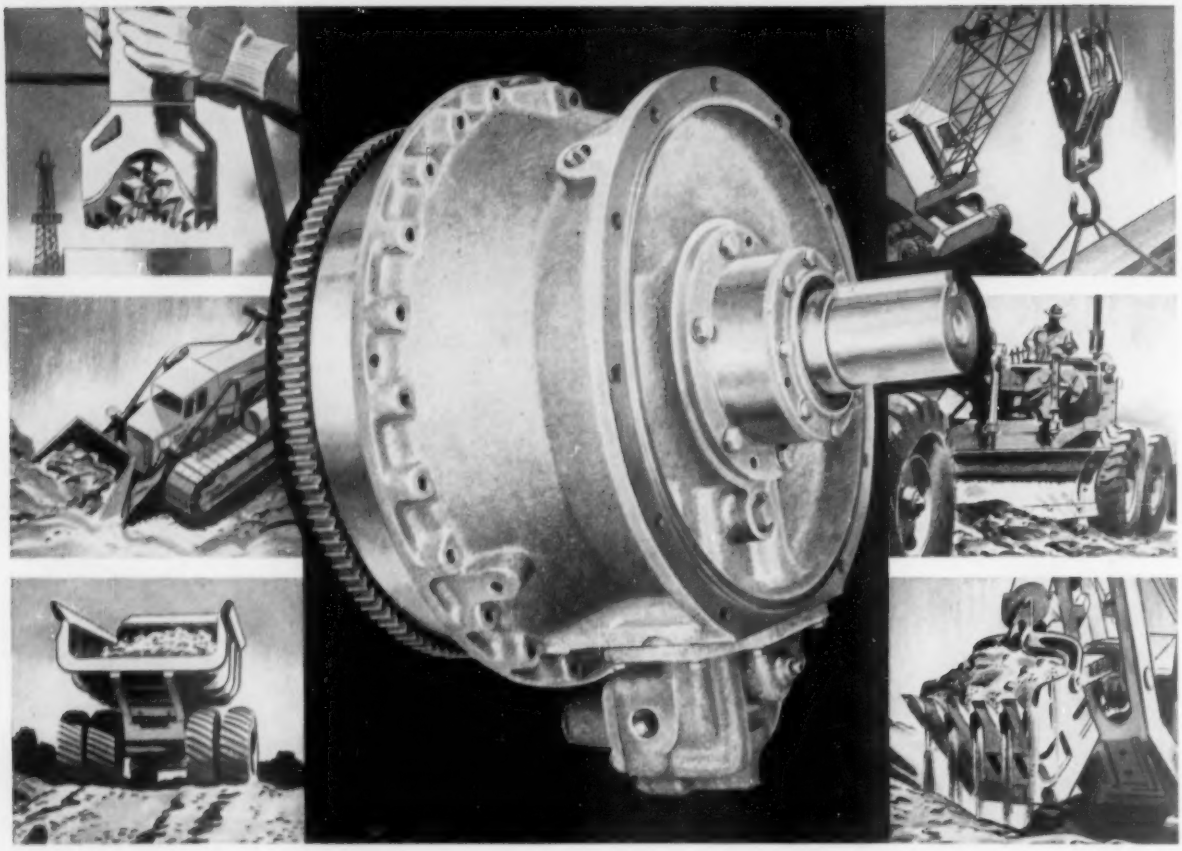
You may be assured that with STRAIGHT GRIP tool joints on your drill pipe, your string will "hang together" under the most severe drilling conditions.

AMERICAN IRON & MACHINE WORKS CO., INC.
MANUFACTURERS OF OIL FIELD EQUIPMENT
A
OKLAHOMA CITY

SPECIFY

AMERICAN IRON
Straight Grip
TOOL JOINTS

Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY, New York



Versatile is the word for the Torqmatic 500.

NAME the gasoline- or Diesel-powered equipment you buy or build in the 150 to 350 horsepower range and it's a sure bet that it's available—or will be soon—with the Series 500 TORQMATIC, *the world's most versatile torque converter.*

Scores of manufacturers—making such varied equipment as cranes, shovels, drilling rigs, log loaders, ditchers, industrial locomotives, scrapers, graders and off-highway trucks—specify the TORQMATIC 500 in the equipment they build, and with good reason.

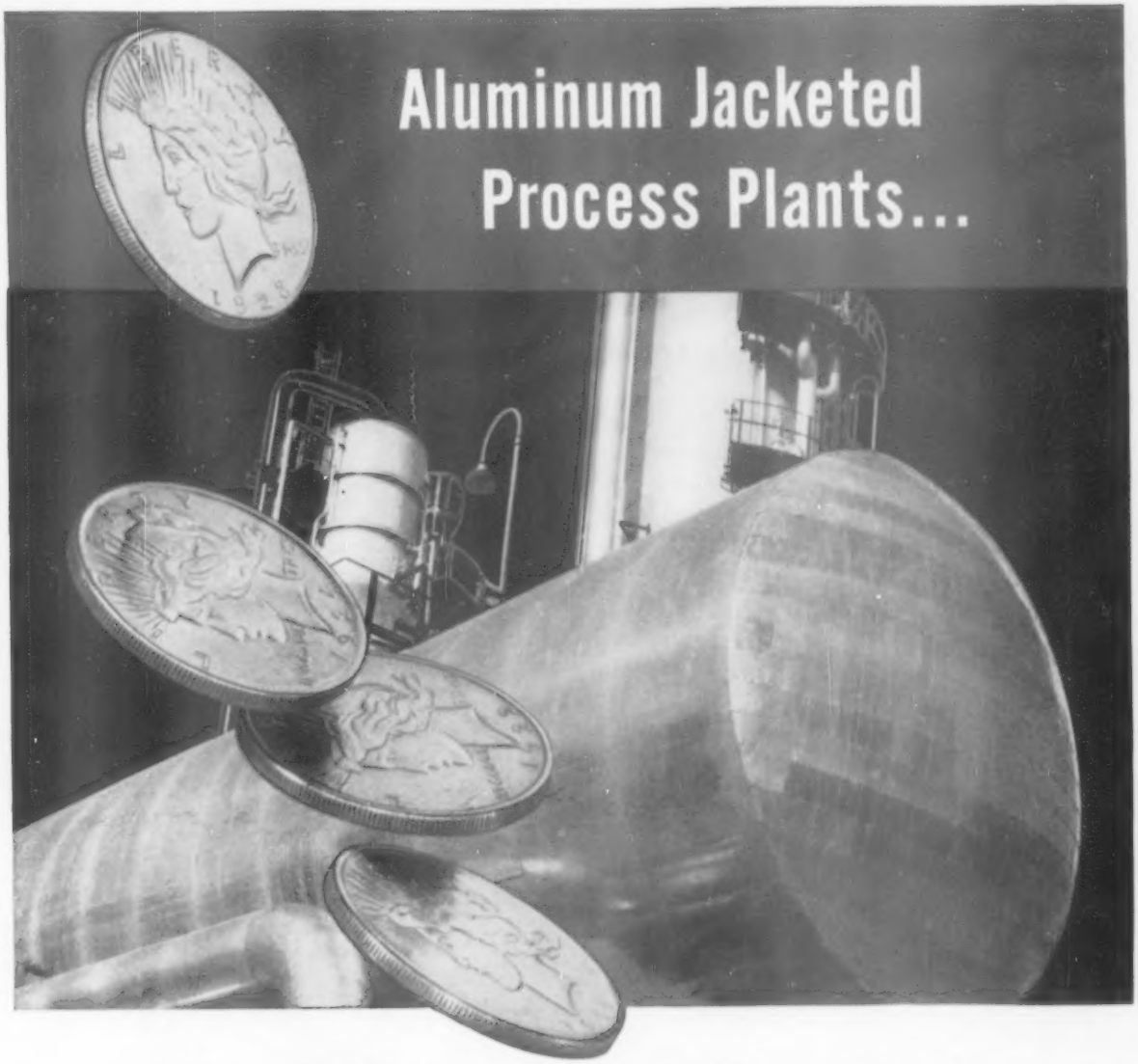
In one standard housing it gives them a choice of 4 ranges, 7 torque ratios—*and* permits operators to standardize on *one* type of converter for *all* their equipment within the horsepower range.

In many applications it permits the use of lower horsepower engines with no reduction in *working* power because the TORQMATIC 500 multiplies engine torque anywhere from 250% to 360%—*and* means equipment owners will cut operating costs and get more work done per shift.

For full details on the Series 500 TORQMATIC Converter in your equipment write to:

Allison Division of General Motors
Box 894R, Indianapolis 6, Indiana

GM TORQMATIC *Allison* TORQMATIC DRIVES



...Stay Bright as the Dollars You Save

Aluminum resists rust and corrosion due to chemicals, gases, plant atmospheres, coastal environments. You enjoy the natural "bright-as-a-dollar" appearance of this long-lasting metal. You save the expense of painting. You save many dollars on replacement of equipment often destroyed by rust and corrosion.

You benefit in other ways, too, with aluminum. It's non-sparking. Eliminates much of the danger of costly fires and explosions. Makes it ideal for walk-ways and tank decks.

Aluminum is versatile. You get natural insulation and high heat transfer from aluminum in many plant uses. Use it for heat exchangers, high pressure steam lines, fractioning towers and many other applications.

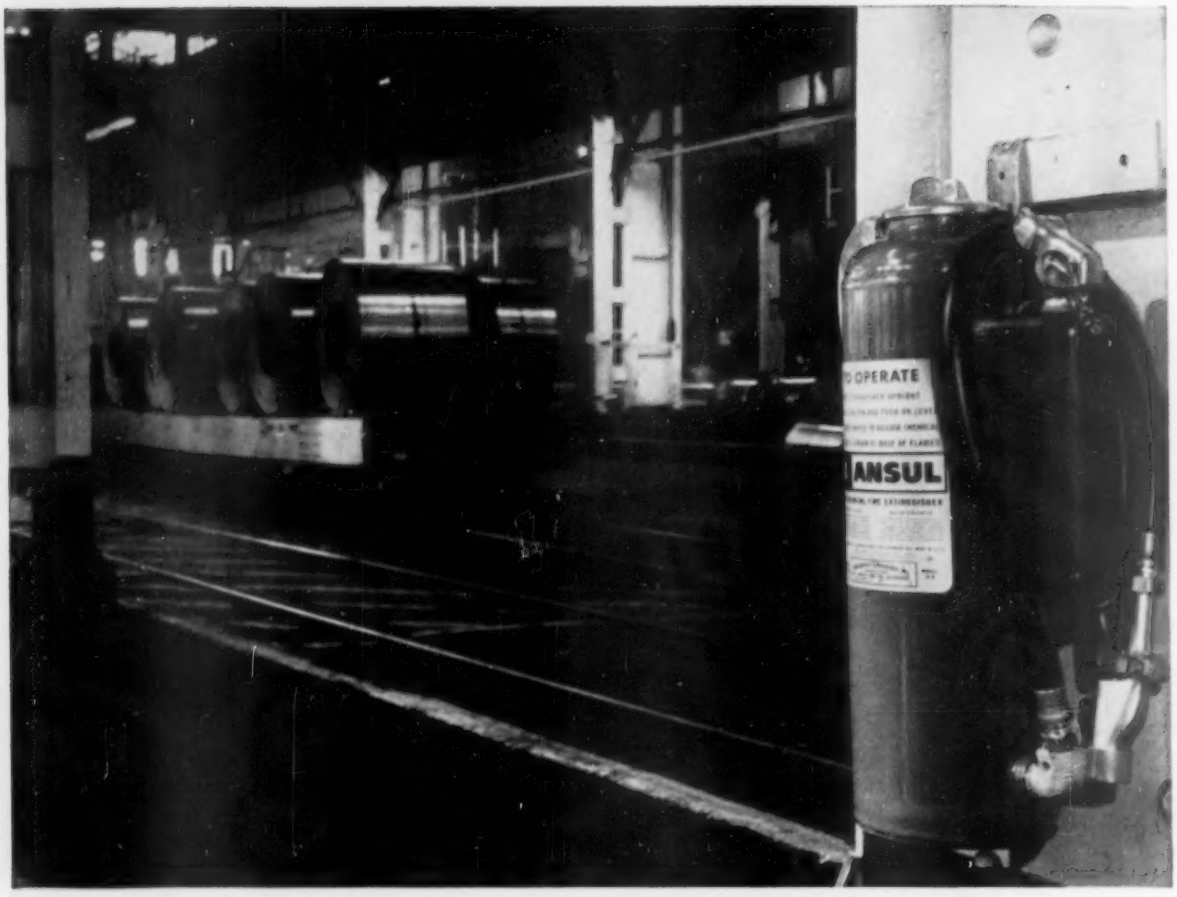
Wherever you use aluminum, it remains bright, lasts long, and saves you money. To get more information on aluminum in the process industries, call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write *Reynolds Metals Company, P.O. Box 1800-CR, Louisville 1, Kentucky.*

The Finest Products Made with Aluminum

are made with

REYNOLDS ALUMINUM

See "FRONTIER", Reynolds exciting dramatic series, Sundays, NBC-TV



Protect your plant with the same Ansul extinguishers that guard this big steel mill

Well-planned safety and fire prevention programs are doing their share to protect lives, property and production schedules at the Great Lakes Corporation, Detroit, Mich., division of National Steel Corporation. Ansul fire extinguishers are playing a part in this successful program.

Your safety program deserves the best in fire protection. Remember, fire doesn't give you a second chance. Here are three big reasons why Ansul dry chemical extinguishers can take the worry out of your fire protection program and help you maintain a safety record to be proud of:

First. Ansul extinguishers are *dependable.* They are always ready for action, even under severe exposure conditions. Weather-tight construction assures this dependability. *Second.* Ansul extinguishers are *effective.* Patented nozzles deliver either a straight or fan stream, depending upon the hazard. This is an Ansul exclusive for more effective fire control. *Third.* Ansul extinguishers are backed by a *five-year warranty.* This is the best way we know of saying that Ansul extinguishers are the finest of their kind made anywhere. No other manufacturer offers this important warranty.

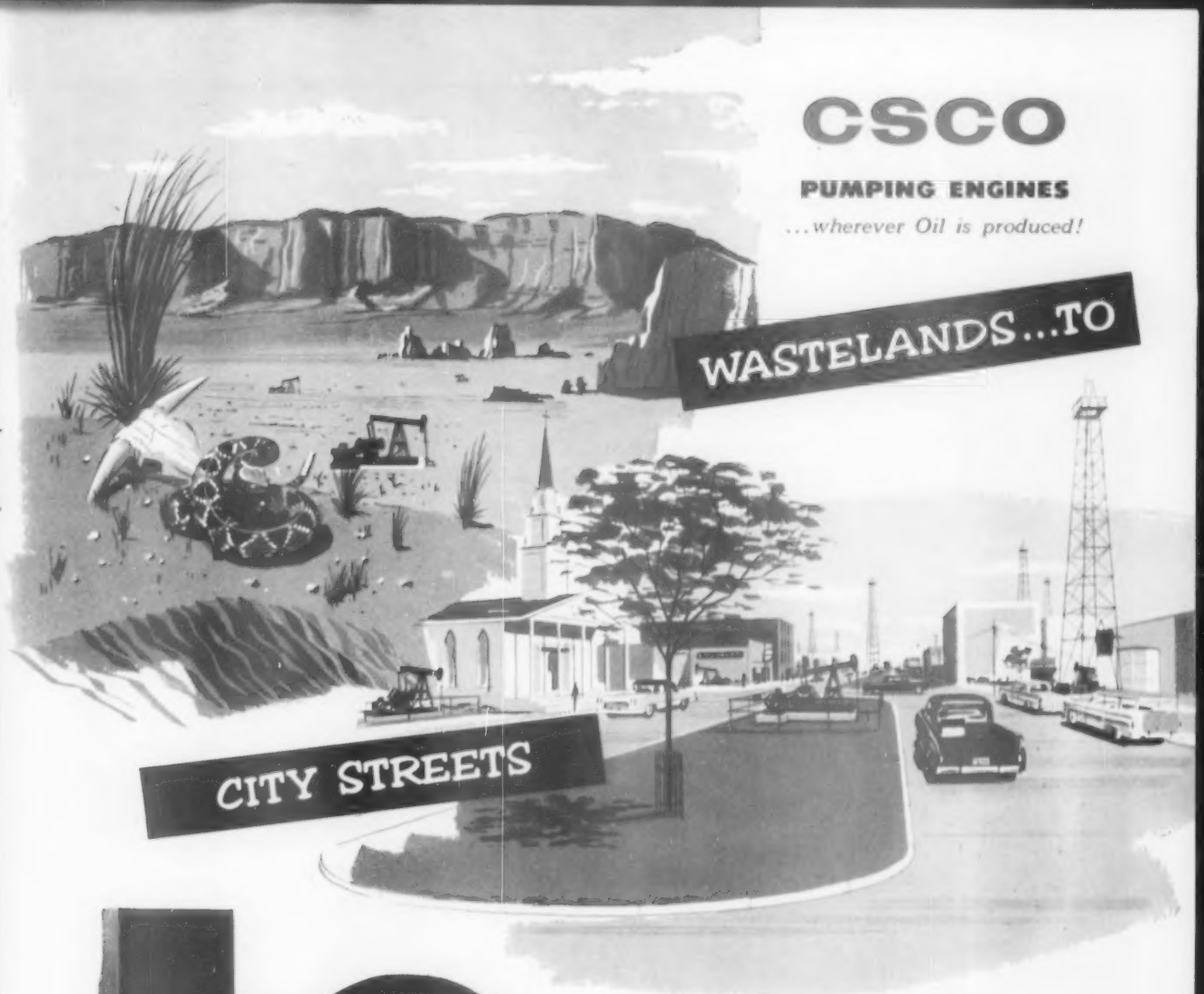
Get in touch with your local ANSUL MAN through the yellow pages of your phone directory, or write direct to ANSUL CHEMICAL COMPANY, DEPT. OG-5A, MARINETTE, WISCONSIN.

ANSUL

CSCO

PUMPING ENGINES

...wherever Oil is produced!



Whether Operating in Isolated or Crowded Areas—Under All Conditions—CSCO Pumping Engines are Easiest to Maintain

Only CSCO Engines have ALL 4 of these important features:

EASY TO REPAIR . . . CSCO parts needing repair or attention can be removed from the engine with a minimum of disturbance of adjacent parts or assemblies. The reason: CSCO exclusive design embodies unit assemblies permitting quick and easy accessibility. For example, the piston and rod assembly is easily removed through the crankcase without draining the water or oil. No other essential parts are disturbed!

EASY TO SERVICE . . . There's no need to stop a CSCO to check oil level . . . to add oil . . . to check water level . . . or to add water. And you can SEE when an oil change is needed, for on a CSCO the oil level is plainly visible at all times. Instant wrenchless access to the crankcase, through the extra large opening, makes oil changing and cleaning out of the oil sump easy and quick. Since there's no need to stop, there's no need to restart!

EASY AND SAFE TO START . . . CSCO Engines were designed for oil well pumping — and of top engineering importance was easy and safe starting.

SMOOTH, STEADY OPERATION . . . Flywheel inertia provides peak power while oil damped governor holds throttle steady — permitting engine to average demand, up to full capacity.

CSCO Pumping Engines are available through Supply Stores other than Continental

CONTINENTAL

Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY

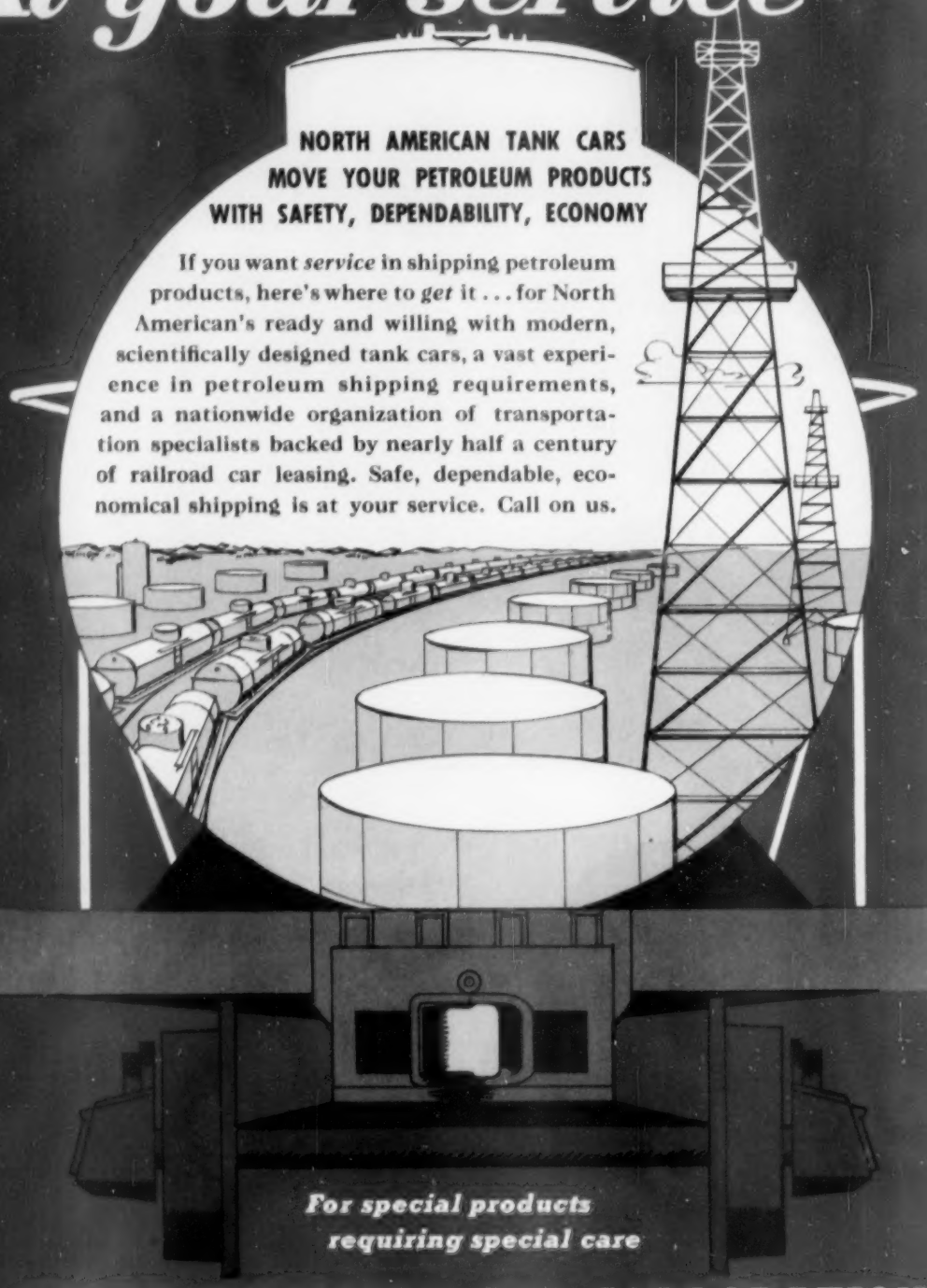
A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

The Petroleum Industry . . . Since 1859 Helping Make America Great

At your service



NORTH AMERICAN TANK CARS MOVE YOUR PETROLEUM PRODUCTS WITH SAFETY, DEPENDABILITY, ECONOMY

If you want *service* in shipping petroleum products, here's where to *get* it . . . for North American's ready and willing with modern, scientifically designed tank cars, a vast experience in petroleum shipping requirements, and a nationwide organization of transportation specialists backed by nearly half a century of railroad car leasing. Safe, dependable, economical shipping is at your service. Call on us.

For special products requiring special care

NORTH AMERICAN CAR CORPORATION

NORTH WESTERN REFRIGERATOR LINE COMPANY
MATHERS HUMANE STOCK TRANSPORTATION COMPANY

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS

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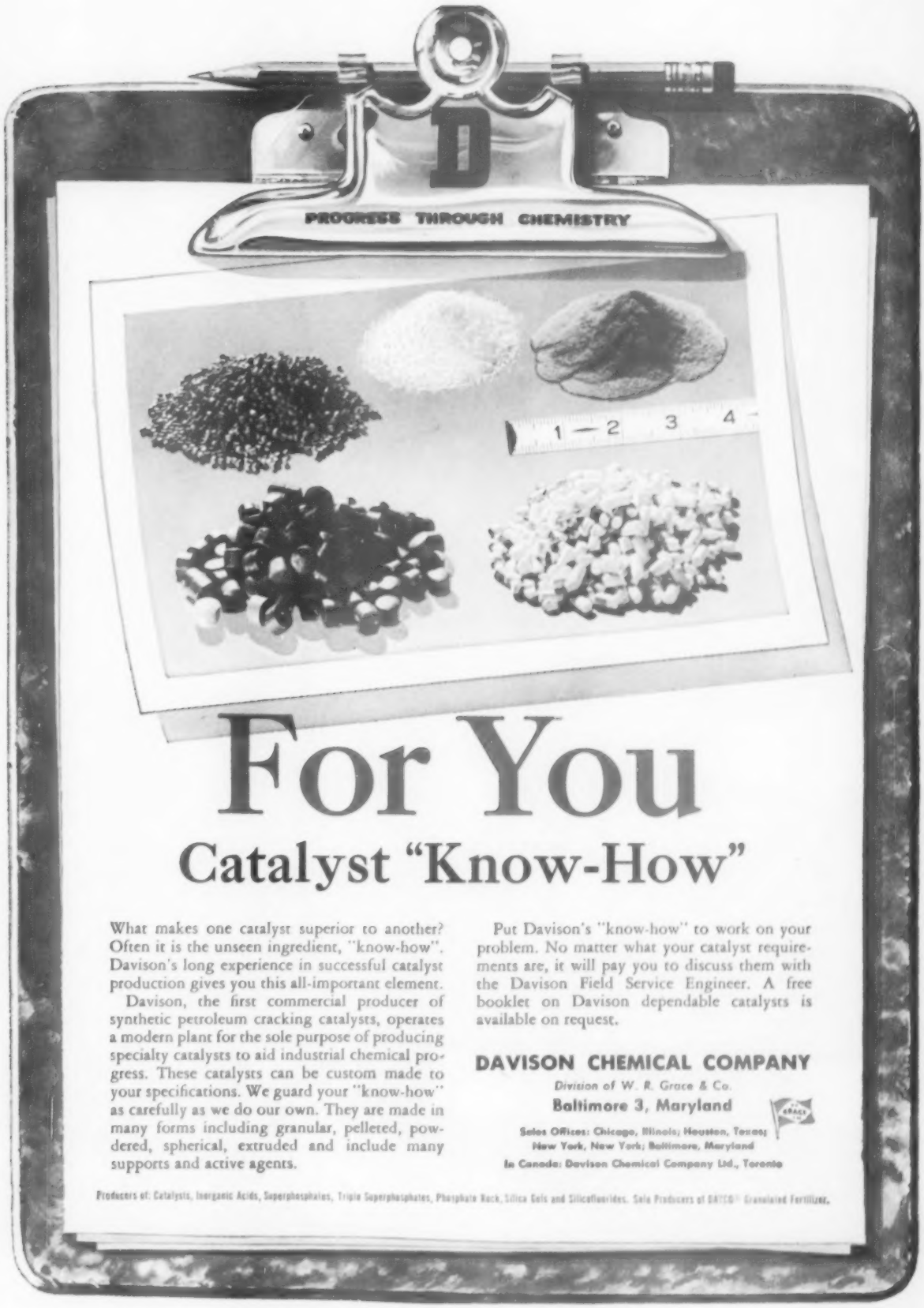


For You

Catalyst "Know-How"

What makes one catalyst superior to another? Often it is the unseen ingredient, "know-how". Davison's long experience in successful catalyst production gives you this all-important element.

Davison, the first commercial producer of synthetic petroleum cracking catalysts, operates a modern plant for the sole purpose of producing specialty catalysts to aid industrial chemical progress. These catalysts can be custom made to your specifications. We guard your "know-how" as carefully as we do our own. They are made in many forms including granular, pelleted, powdered, spherical, extruded and include many supports and active agents.

Put Davison's "know-how" to work on your problem. No matter what your catalyst requirements are, it will pay you to discuss them with the Davison Field Service Engineer. A free booklet on Davison dependable catalysts is available on request.

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

Sales Offices: Chicago, Illinois; Houston, Texas; New York, New York; Baltimore, Maryland

In Canada: Davison Chemical Company Ltd., Toronto

Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizer.

A Better Diet for 300 Horses!

As automotive engines reach new horsepower and compression ratio heights, refiners must be ready with super-fuels necessary for their full measure of performance. After all, a diet made for 50 horses just won't do the job for 300.

For more than 40 years, Universal has made available to refiners everywhere new and more economical processes for producing the improved petroleum products needed to meet market requirements. These processes include:

CONTINUOUS THERMAL CRACKING, the first major improvement in refining methods, developed by UOP in the industry's early days.

POLYMERIZATION, a catalytic process developed by UOP and used to convert refinery waste gases into premium quality gasoline.

FLUID CATALYTIC CRACKING, developed to produce greater yields of liquid products and higher octane number gasoline.

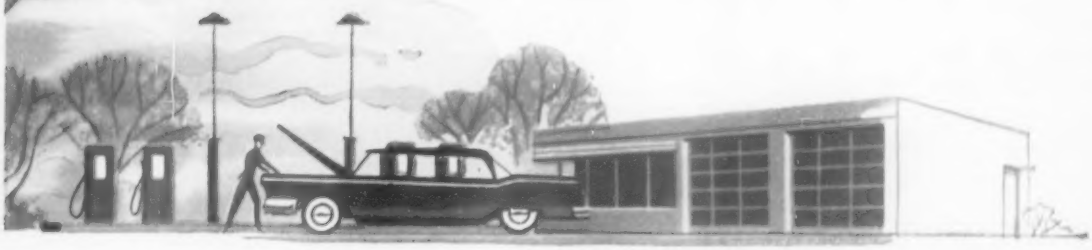
PLATFORMING, with which UOP pioneered the use of platinum in a reforming catalyst and originated the commercial designs of catalytic reforming units.

REXFORMING, a combination of UOP Platforming with solvent extraction which permits a refiner to produce even higher octane gasolines.

"HF" ALKYLATION, a process developed by UOP for producing alkylate, a high octane gasoline blending component, using hydrofluoric acid as the catalyst.

UNIFINING, the process which employs by-product hydrogen from UOP Platforming units to remove sulfur, nitrogen, oxygen and metallic impurities from petroleum distillates by catalytic hydrogenation.

These and other UOP processes, individually or collectively, can provide the answer to most refining problems. We will be glad to tell you how they can help with yours.



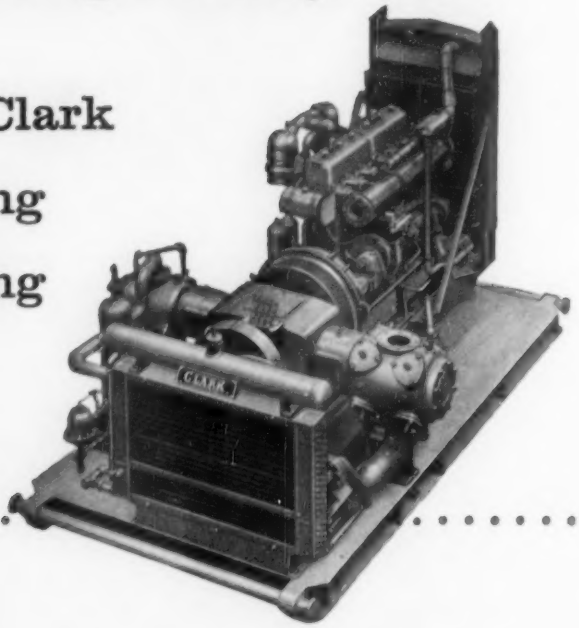
UOP UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

Forty Years of Leadership in Petroleum Refining Technology

NOW...a compact 75-200 bhp Packaged Compressor

Designed by Clark for gas lifting or gathering



FEATURES

BALANCED/OPPOSED COMPRESSOR DESIGN
Virtually vibrationless . . . a couple of yards of concrete will level it.

DIRECT CONNECTED
Eliminates belts or gear drives.

ONE PIECE SKID
Only 7' 3" x 15', rigid heavy "I" beam construction.

CONSERVATIVE PISTON SPEED
Lower than on most Clark stationary compressors.

HEAVY DUTY RADIATOR
Straight finned tubes. Easy to inspect or clean, inside or out.

FACTORY ASSEMBLED AND TESTED
No field assembly. Shipped as a complete unit.

STANDARD ENGINE DESIGN
Five makes of proved engine designs available.

APPLICATIONS
Use it for gas lifting, gas gathering, gas boosting, pipeline testing, recycle plant feeders, other field services.

You asked for this field compressor—as rugged, compact and perfectly balanced as the famed "Midget Angle" but of half the horsepower.

Now you have it, in the new Clark Model CFA. Rated at 75-200 bhp , this packaged unit is ideal for gas lifting or gathering.

The CFA uses a new specially designed 5" stroke Balanced/Opposed compressor directly connected to a standard design gas engine. The compressor and engine, together with radiator, scrubber, etc., are mounted on a rugged steel skid measuring only 7' 3" x 15'.

The CFA is virtually vibrationless in operation because of its Balanced/Opposed action. In most cases the small amount of concrete used to level the unit will provide ample support. Direct drive eliminates the need for cumbersome belts and gears.

Easily and speedily transported on an average size truck, this new field compressor can also be operated on truck or floating barge.

The CFA is factory assembled, tested and shipped as a complete unit. Because of standardization the CFA can be shipped from stock in most instances.

There is a Clark CFA specialist in your area to give you all the facts. If you require greater horsepower, ask him about the Clark HMA and HMAB.

CLARK BROS. CO., OLEAN, N. Y.
ONE OF THE DRESSER INDUSTRIES
Offices in Principal Cities Throughout the World

CFA now on tour

—in Oklahoma, Kansas, Colorado, Texas and Louisiana.

Watch your newspaper for date and location of demonstration.

CLARK® — ONE OF THE DRESSER INDUSTRIES

Packaged Compressors

There's MORE *Cooling Surface* with Allis-Chalmers MOTORS

Why Rib-Type Motors Won't Fry

STRETCH OUT RIB DESIGN of Allis-Chalmers motors and see the greater cooling area provided — as much as 43% on many models. Insulation won't fry under normal conditions with deep-rib construction because every rib adds to the heat-dissipating surfaces. The result—moderate overloads can be taken in stride with little fear of burnouts.

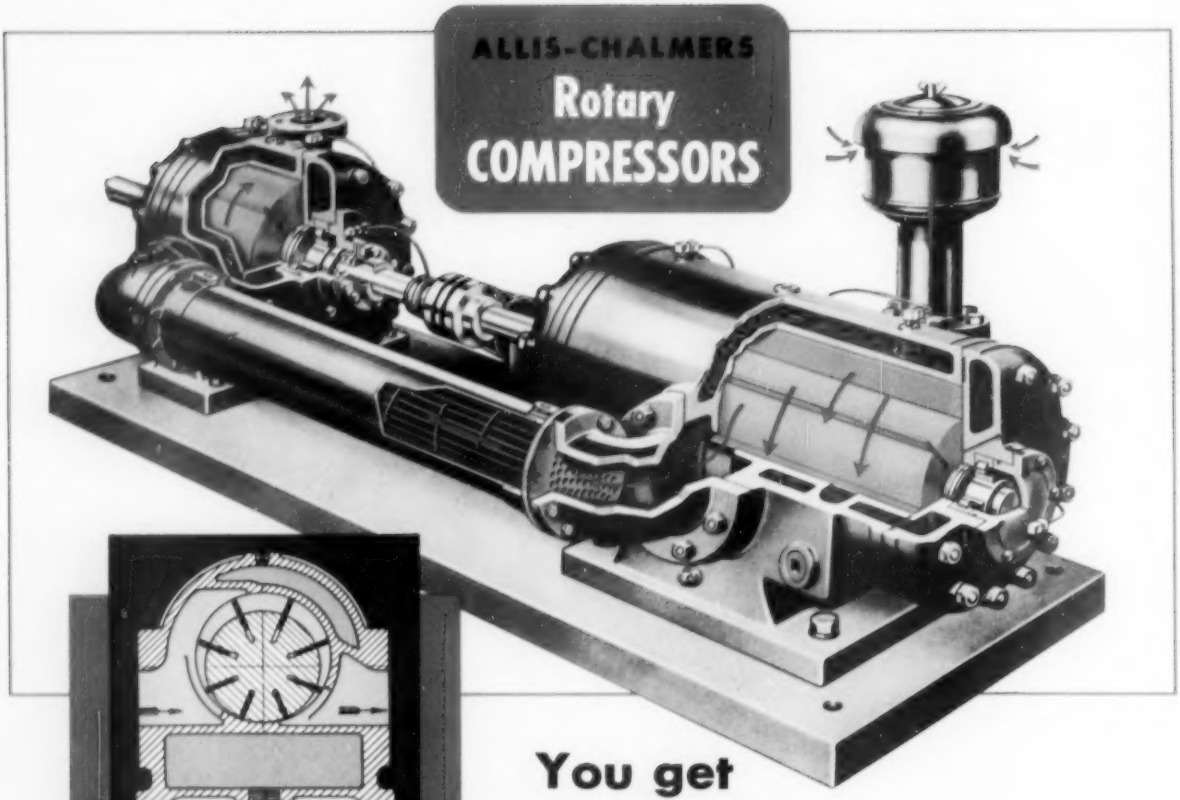
As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby A-C district office, distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

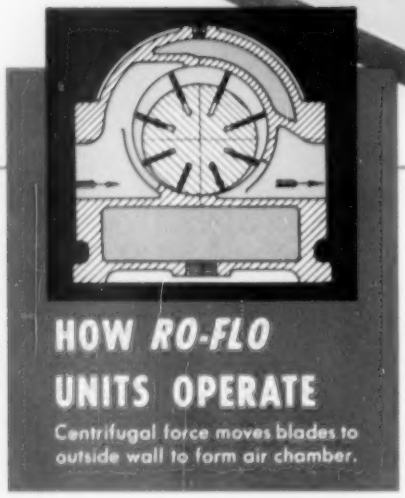
ALLIS-CHALMERS

A-4882

ALLIS-CHALMERS

Rotary COMPRESSORS





You get MORE ADVANTAGES with RO-FLO units for shop air, drilling, gas handling

TYPE and SIZE for EVERY NEED

Both single and two-stage *Ro-Flo* compressors are available. Single-stage units for pressures to 50 pounds gauge, and volumes from 42 to 3245 cfm.

Two-stage units in twelve sizes for 250 to 1800 cfm at pressures from 60 to 125 pounds gauge.

Single and two-stage *Ro-Flo* vacuum pumps for vacuums to 0.3 inch mercury absolute, from 22 to 5950 cfm.

Call your nearest A-C office or write for bulletins 16B8244 (two stage) and 16B8126 (single stage). Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

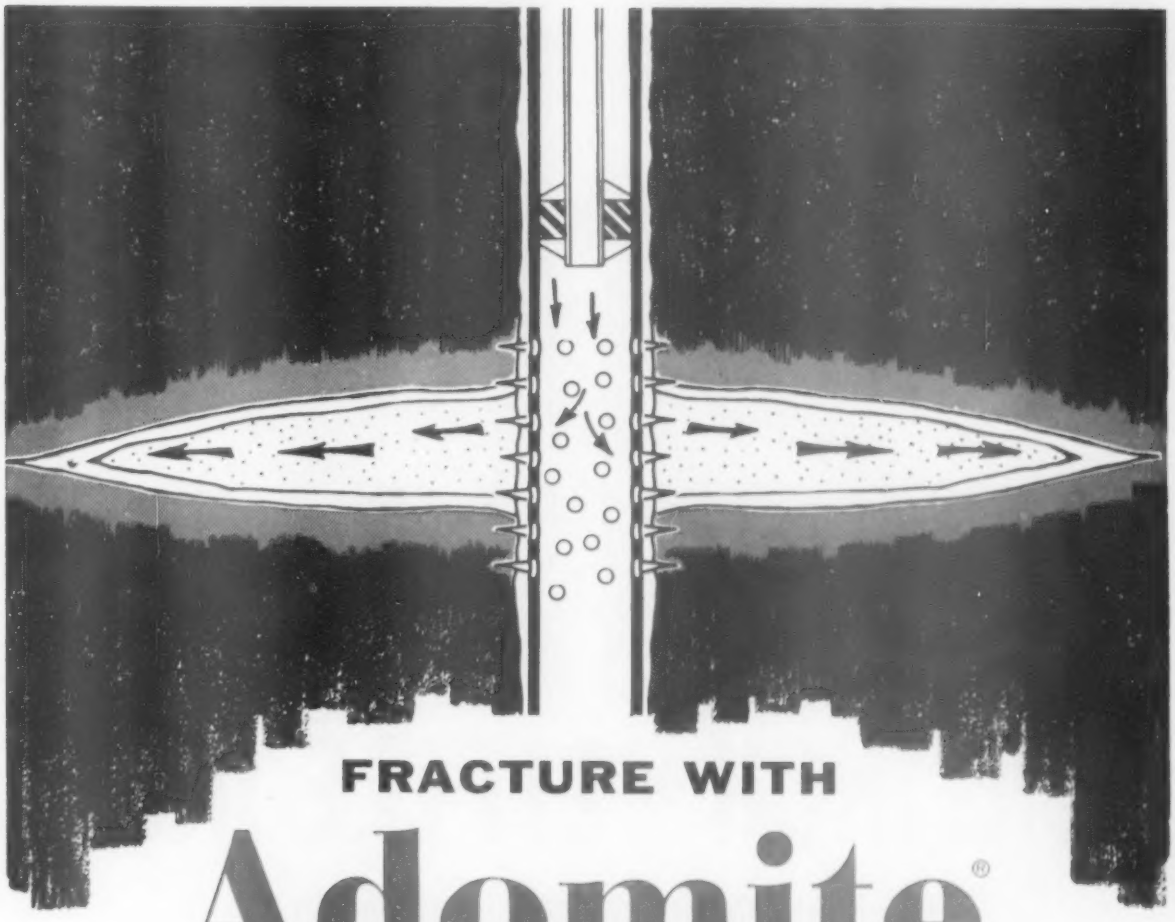
1. **CONSTANT EFFICIENCY** — During operation the sliding vanes of the rotor press against the cylinder wall to form air cells. Even if these vanes wear, the rotating force holds them in contact with the cylinder wall so that efficiency and air flow never change.
2. **LOW-COST FOUNDATIONS** — Smooth rotation cuts vibration. This eliminates need for heavy foundations used with reciprocating-type units. Small units can be bolted directly to the floor. Large units need only a simple slab.
3. **COMPACTNESS** — No extra weight or extra size is needed to dampen vibration. Every inch is devoted to air or gas handling.
4. **LOW MAINTENANCE** — There is no wear and tear from shock and vibration . . . no pistons and valves.

Ro-Flo is an Allis-Chalmers trademark.

A-5028

ALLIS-CHALMERS

CUT FLUID LOSS TO A MINIMUM



FRACTURE WITH

Adomite®

Specify the fluid-loss control agent proven profitable in thousands of successful field treatments

Only Adomite gives you all these advantages — so effectively	Larger fracturing per volume of treatment—or the same size fracture with a lesser volume of fracturing oil.	Acceptance of fracturing fluid by pipeline companies —fracturing oils made from lease crude and Adomite are completely acceptable to pipelines.	Fewer sand-outs. Adomite prevents loss of fluid into the rock matrix, preventing buildup of sand concentration in the fracture.
Lower transportation costs. The fracturing oil costs you nothing when you use your own lease crudes.	Decreased friction losses. The low viscosity of Adomite-treated crudes or gelled crudes permits the use of less pumping equipment than viscous refinery residuals.	Compatibility of fracturing fluid with reservoir oils. Since Adomite is used with lease crudes, the fracturing fluid is fully compatible.	Fluid loss control with one additive. Adomite is all you need to control fluid loss of kerosene, crudes, gelled crudes or refinery residuals.

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BE SURE TO TELL YOUR SERVICE COMPANY TO USE ADOMITE

Adomite — developed and manufactured by Continental Oil Company

Adomite ® — trade-mark, Continental Oil Company

BIG INCH OR LITTLE INCH

You get automatic low-cost application when you specify high-quality Polyken

HOW IS THIS POSSIBLE? Factory controlled production from controlled materials—the source of quality—is likewise the source of low-cost field application.

By transferring your coating production *to our plant*, you get:

1. *Polyken* "Controlled Strength"—careful control in the selection and mass processing of raw materials to assure you "all work—no waste";
2. Uniform composition, thickness and adhesion;
3. Application right from the roll—little handling, no heat, no thinners, no solvents, no drying, no cooling, no cleanup time required;
4. High-speed, low-labor power taping for "big inch" as well as "little inch" installations;
5. Lowest equipment investment and manpower costs.

We can't figure your costs here in dollars and cents. But show us your plans—and we suspect you'll be surprised at how little this method costs you.

Let's talk it over now. Write, wire or phone today. The Kendall Company, Polyken Sales Division, Department OG-E, 222 West Adams St., Chicago 6, Illinois (Randolph 6-4250).

Complete catalog, Sweet's Industrial Construction File, Sec. 9c/Ke

Polyken®

CONTROLLED STRENGTH

PROTECTIVE COATINGS

THE KENDALL CO., POLYKEN SALES DIVISION

. . . RED TAPE can be cut at WILSON SUPPLY CO.

The Drilling and Producing Industry moves fast—

decisions are often made quickly . . . time is important.

Wilson Supply Company is large enough to meet

every demand for performance proven products and service—

yet small enough to make rigid policies unnecessary.

Some Red tape may be a part of every business—

but Red tape **can** be cut at Wilson Supply Company.

"WHAT YOU WANT—WHEN YOU WANT IT"

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TEXAS: Alice, Corpus Christi, Victoria, McAllen, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Sherman, Odessa. LOUISIANA: Lake Charles, New Iberia, Houma, Harvey, Shreveport.

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HOUSTON, TEXAS

ROCKWELL-

Often Copied...

40th YEAR *of*

Nordstrom VALVES

Never Equaled

Rockwell-Nordstrom is the *original* lubricated plug valve. But that is only part of the story behind forty years of lubricated plug valve leadership. Starting with the first valve, *every major development* in lubricated plug valves has come to you *first* in a Rockwell-Nordstrom valve. Today, as always, the *oldest* lubricated plug valve is also the *newest* in terms of better performance, longer life and lower cost.

Below are listed only a few of the more than ninety basic Rockwell-Nordstrom valve and lubricant innovations. They are the reasons why Rockwell-Nordstrom valves—although often copied—have *never* been equaled. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

Lubricant Sealed for Positive Shut-off

first... for forty years *Here are just a few of more than ninety basic valve and lubricant innovations that have maintained the leadership of Rockwell-Nordstrom valves—through better performance, longer life and lower cost.*

- **FIRST Lubricated Plug Valve**
- **FIRST Sealdport* pressurized lubricant sealing**
- **FIRST Hydraulic plug jacking for fast, dependable operation**
- **FIRST Hypreseal* for high pressure plug valve service (still exclusive)**
- **FIRST Special plug and body coatings—longer life on "tough" services**
- **FIRST Automatic shut-off valves for gas pipelines**
- **FIRST "Self-Energizing" valve lubricants**
- **FIRST Line of special and general purpose valve lubricants**
- **FIRST Multiport lubricated plug valves for 3-way and 4-way flow control**
- **FIRST Lubricated plug valve for low temperature service**
- **FIRST Venturi valve for lower cost on larger lines**
- **FIRST Lubricated plug Christmas tree valves**

*Registered trade mark Rockwell Manufacturing Company

lubricated plug valve leadership

SAVE 2 WAYS WITH

MARTIN RUBBER GUIDE CAGES

1. GREATER PRODUCING PROFITS *because:*

Martin Cages last much longer. The oil-proof rubber guides do the trick, by absorbing the ball peen hammer action of the hard balls. They also have superior resistance to sand abrasion. And they can be replaced.

2. GREATER PRODUCING PROFITS *because:*

Ball & Seat life is usually doubled, on the average. With the rubber guides, there is much less chattering, chipping and pitting. Ball falls true on seat. Such improvement in Ball & Seat life eliminates a lot of pulling expense.

In the last year alone, new users of Martin Cages have increased by 85%. The word is getting around. More and more economy-minded producers are learning about the advantages of the Martin Cages! . . . Manufactured in open and closed types . . . all diameters and styles. Write for John Martin Catalog No. 4 today. *Martin Cages are available through all supply stores.*

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.

Is it true what they say about J&L and CABOT

Cabot units plus J&L parts service in the United States and Canada add up to a mighty satisfactory way to pump a well. Literally thousands of producers are enthusiastically agreed on this.

There is much more than pride of ownership and far more than meets the casual eye in this enthusiasm for Cabot units. To understand fully, you've got to know how Cabot employs torsional deflection to eliminate friction and you've got to know about a lot of other things that contribute to the remarkable adaptability and endurance of Cabot units. Moreover, you've got to know about the helpful, enthusiastic attitude of J&L men everywhere.

Yes, it IS true what they say about J&L and Cabot! Ask your J&L store for a Cabot bulletin, and talk this over with J&L men who know what Cabot units can do for a canny producer.

YOU CAN'T STOP PROGRESS. FOLKS USED TO CONSIDER THEMSELVES LUCKY WHO LIVED WITHIN "TOTING" DISTANCE OF A SPRING. THEN ALONG CAME THE WELL AND THE PITCHER PUMP. NOW THE FAUCET HAS MADE THE SPRING AND THE WELL SEEM OBSOLETE . . . JUST A "TWIST OF THE WRIST" AND WATER FLOWS FREELY!

J&L STEEL

Cabot Pumping Units are as automatic as the modern water faucet and require just about as much attention. *Less* than a twist of the wrist starts your Century Motor and Cabot does the rest.

133-M

Jones & Laughlin STEEL CORPORATION

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

Fifth in a series of opportunities to step up production—cut costs.

Planning to Retube a Butane Condenser?

The opportunity to boost heat duty of butane condensers —without the expense of investing in new equipment—is available to processing engineers *right now!*

The secret? Retube with Wolverine Trufin* Type S/T—the only integral finned condenser tube for shell and tube heat exchangers.

By replacing prime surface tube with Trufin Type S/T, you can obtain as much as 2½ times greater shell side surface area in existing equipment. Result: increased heat duty from present units.

Trufin Type S/T is mechanically interchangeable with plain tube of the same size. It can be rolled or brazed into headers by conventional methods. All the mechanical features of conventional types of heat exchangers as well as the custom designs of individual fabricators can be retained.

Trufin in copper, copper-base alloys, aluminum and electric-welded steel is furnished in a wide range of sizes. It's available with four different kinds of end finishing: both ends finned, both plain, both stripped, or one end plain and the other stripped. You'll save if you specify Trufin when retubing is necessary. *Call Wolverine right now!* And write for a copy of Wolverine's new Opportunity Book. It's proof positive.

DIVISIONS OF
CALUMET & HECLA, INC.

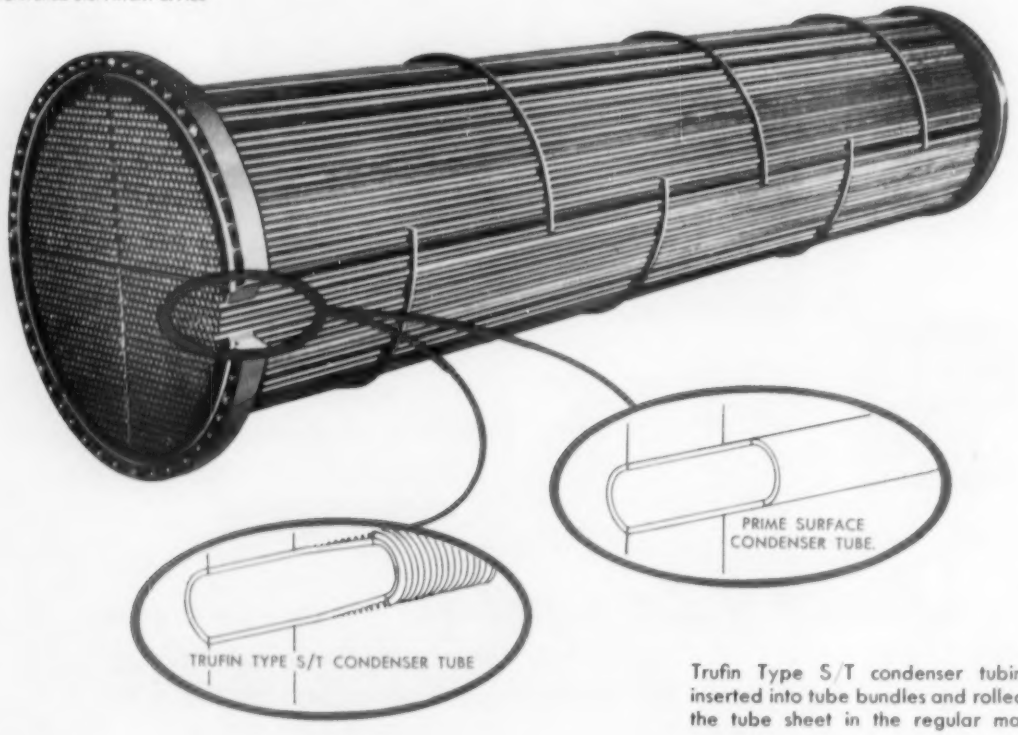
CALUMET DIVISION
WOLVERINE TUBE DIVISION
CANADA VULCANIZER
& EQUIPMENT CO., LTD.
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER CO.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

*REGISTERED U.S. PATENT OFFICE



Trufin Type S/T condenser tubing is inserted into tube bundles and rolled into the tube sheet in the regular manner.

A Condenser Tube for Every Job

PRIME SURFACE TUBE

Wolverine keeps in step with processors' demands—not only with Trufin Type S/T, but with additional types of condenser tubing. From this complete line you can specify exactly the tube you need to meet your particular demands. Into each of these products goes all the research, the engineering skill and Tubemanship that has made Wolverine a leader for more than 38 years. Your tubing dollars develop real stretchability!

PRIME SURFACE TUBE

Wolverine manufactures prime surface tubing in copper, copper-base alloys and aluminum—all quality controlled.

Duplex PRIME SURFACE TUBE

Here's a tube designed to handle two types of corrosive attack simultaneously. It is composed of a tube of one metal and a liner of another. The combination can be any alloy you need to meet special conditions.

DUPLEX PRIME SURFACE TUBE

Duplex TYPE S/T

This tube also is designed for specific corrosive conditions. But, like Trufin, it has integral fins—will boost heat transfer efficiency. It can be used instead of prime surface tube.

TRUFIN TYPE L/C

A high-finned, lightweight aluminum tube is mechanically bonded to an interior liner of the alloy which best beats your corrosion hazard. It provides maximum heat transfer and trouble-free performance at low cost.

DUPLEX TYPE S/T

U-BEND PALLETS

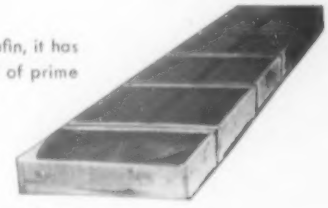
This new Wolverine idea cuts time, reduces storage problems, and saves money. U-bend condenser tubes—either finned or prime surface—are arranged in a disposable box-type pallet in the exact order you specify. All you have to do is feed them directly from pallet to unit.

FIELD ENGINEERING SERVICE

This is a Wolverine "extra"—a staff of highly-skilled tubing technicians. You can get experienced help in solving problems dealing with alloys, corrosion, design or fabrication. You'll find complete information in Wolverine's Condenser Tube Catalog. Send for your copy now. Wolverine Tube, 1449 Central Avenue, Detroit 9, Michigan.

TRUFIN TYPE L/C

U-BEND PALLETS



FIELD ENGINEERING SERVICE

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

DIVISIONS OF CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO., LTD.
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WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

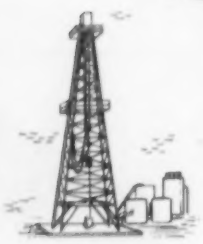
PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

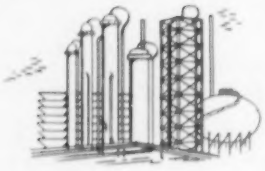
EXPORT DEPARTMENT, 11, EAST 40TH STREET, NEW YORK 16, N. Y.

The Oil Bank of America

Has Opened The Door For Many OIL OPERATIONS

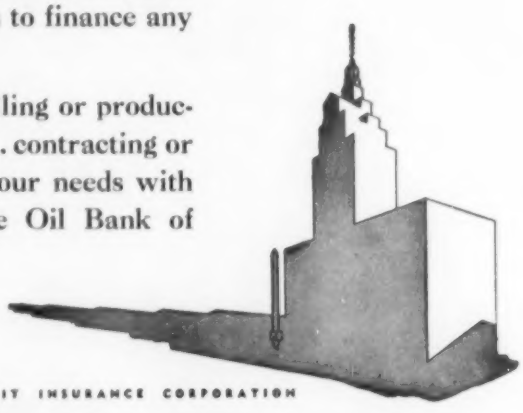
EXPERIENCE • FACILITIES • RESOURCES
KNOW HOW





Vitally close to every phase of the oil business and related industries for many years, National Bank of Tulsa has the broad experience and adequate resources to finance any sound oil operation.

Whether it is exploration, drilling or production . . . pipe line or refining . . . contracting or supply business . . . discuss your needs with the friendly officers of "The Oil Bank of America."

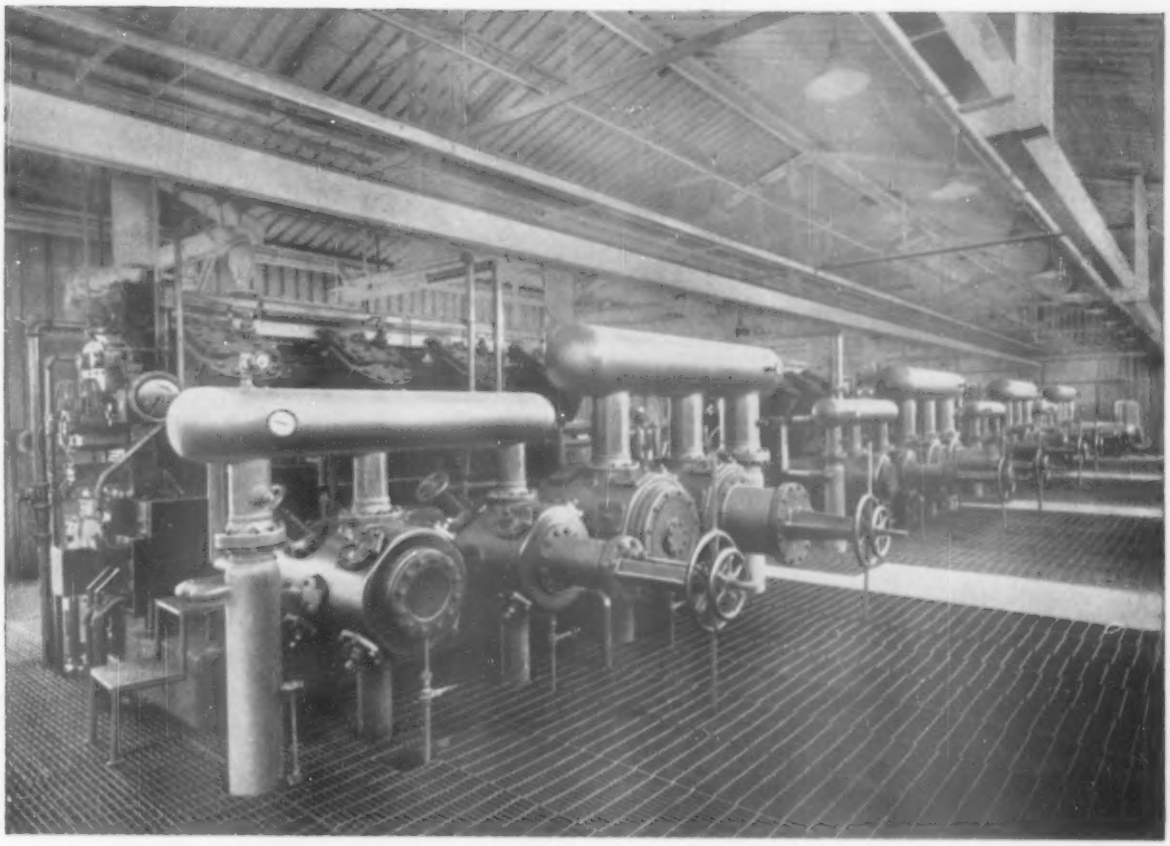


MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA

The Oil Bank of America

OFFERING COMPLETE BANKING AND TRUST SERVICES



SVG gas-engine compressors maintain critical pressures on cat-cracker gas recovery

for National Cooperative Refinery Association

Gas recovery compressors in a catalytic cracking plant must hold constant suction and discharge pressures—a job made difficult by widely-fluctuating volumes flowing through the plant. This problem was solved for the National Cooperative Refinery Association at McPherson, Kansas, by Ingersoll-Rand engineers and SVG gas-engine compressors.

Ingersoll-Rand provided a special control system which keeps suction pressure constant by a choice of several methods, depending on plant conditions. SVG compressors are particularly suitable for such service because of the smooth operation and flexibility of I-R 4-cycle design. Regardless of speed or load, smooth power is maintained automatically by the constant-quality mixing valve. And the famed Ingersoll-Rand reliability is important in a year-round continuous-flow system like this, where compressor failure cannot be tolerated.

Ingersoll-Rand gas-engine compressors are built in sizes from 110 to 2000 hp, for any gas, any pressure. If you have a compressor problem, call your nearby I-R representative. He is always ready to give valuable help.

Ingersoll-Rand

6-395

11 Broadway, New York 4, N. Y.

4-CYCLE

COMPRESSORS • PUMPS • AIR AND ELECTRICAL TOOLS • VACUUM EQUIPMENT • ROCK DRILLS • CONDENSERS • GAS AND DIESEL ENGINES

"For its size, it is the best machine"

FOURWAY EQUIPMENT CO., INC.
AZTEC, N. M.
SAVES TOUGH DIGGING JOBS FOR

LORAIN-Dixie HOE

ON THE EL PASO CO. PIPELINE

At Superior Hill, New Mexico, Fourway Equipment Co., Inc., put a new Lorain-Dixie Hoe to a rugged test. When tough rock digging was encountered on this El Paso Co. line, the Lorain-Dixie moved in and dug up to 1000 ft. of trench, 30" wide by 36" deep, per day. Fourway Equipment Co., Inc. were so pleased with Lorain-Dixie performance they report . . . "For its size, it is the best machine."

Pipelining is never an easy job, whether it's digging trench, stringing pipe, or any other kind of excavating or material handling. That's why you should equip your spread with dependable Lorains. The Lorain-Dixie is the newest in the small rubber-tire machine class. Dollar-for-dollar it packs more features, more performance and more long-lived quality than anything yet introduced to the oil field industry. Check the *big values* below and see your Thew-Lorain Distributor for all the facts.

BIG VALUES THAT MAKE THE LORAIN-Dixie THE BEST BUY FOR YOUR MONEY

• **ECONOMICAL TO OWN AND OPERATE . . .** Priced with the lowest, yet built to outperform • Uses only 1 gallon of fuel per hour • Clean-cut, simple, open design—easy and simple to adjust and service in the field—readily understood by any mechanic.

• **HIGH QUALITY TURNTABLE DESIGN . . .** Low center of gravity—no bounce or rock • 5 interchangeable clutches with separate hydraulic system for each • Machine cut spur gears • Horizontal power shafts on anti-friction bearings—each shaft easily removed • 4 top rollers and 4 adjustable bottom hook rollers • Independent boom hoist.

• **CHOICE OF BOOMS AND MOUNTING . . .** Usable as a ⅜-yd. shovel, 6-ton crane, clamshell, dragline, hoe • Folding crane boom for road travel • Can be factory-mounted on any of 3 factory-approved Carriers or field-mounted on commercial motor trucks.

Best of all — the Lorain-Dixie is built by Thew-Lorain . . . backed by the parts and service facilities of your Thew-Lorain Distributor.

THEW LORAIN®
THE THEW SHOVEL CO., LORAIN, OHIO

The Lorain-Dixie is the smallest Shovel-Crane-Hoe in the Lorain line. Your Thew-Lorain Distributor offers shovel sizes through 2½ cu. yds. . . . crane capacities up to 61 tons. Both crawler and rubber-tire mountings for many sizes.

Operation "Explosion"

Control of liquids and gases has been a classic problem to designers for endless ages. Never before, however, have valves been called upon to control such a variety of difficult materials under such extreme conditions. Problems of our age present a challenge which has produced radical improvements in valve design.

Here at Cameron the remarkable Non-Lubricated Lift-Plug Valve is working ranges of pressure, volume and time which produce controlled "explosions." These high speed operating cycles simulate actual operating conditions to which our valves are subjected in service applications today.

The versatile Cameron Lift-Plug Valve is replacing more and more ordinary valves in many difficult services. Temperatures to 1600°F., corrosive acids, slurries, LPG and even beverages and foods are among the many applications in which these valves have had outstanding records for a number of years. You may not need to control an "explosion" in your processes but most likely you have a place where the Cameron Non-Lubricated Lift-Plug Valve can save time and money.

Write or call . . .

Cameron

IRON WORKS, INC.

P. O. Box 1212 - Houston, Texas

Export Office, 7912 Empire State Bldg., New York City. In England: Cameron Iron Works, Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

WORLD LEADER IN DEPENDABLE HIGH PRESSURE CONTROL FOR THE OIL INDUSTRY

There's a World of Satisfaction

. . . for oil men the world over who rely on Mid-Continent Supply Co. for Sure Service, Sure Supply

EXPORT DIVISION
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MID-CONTINENT
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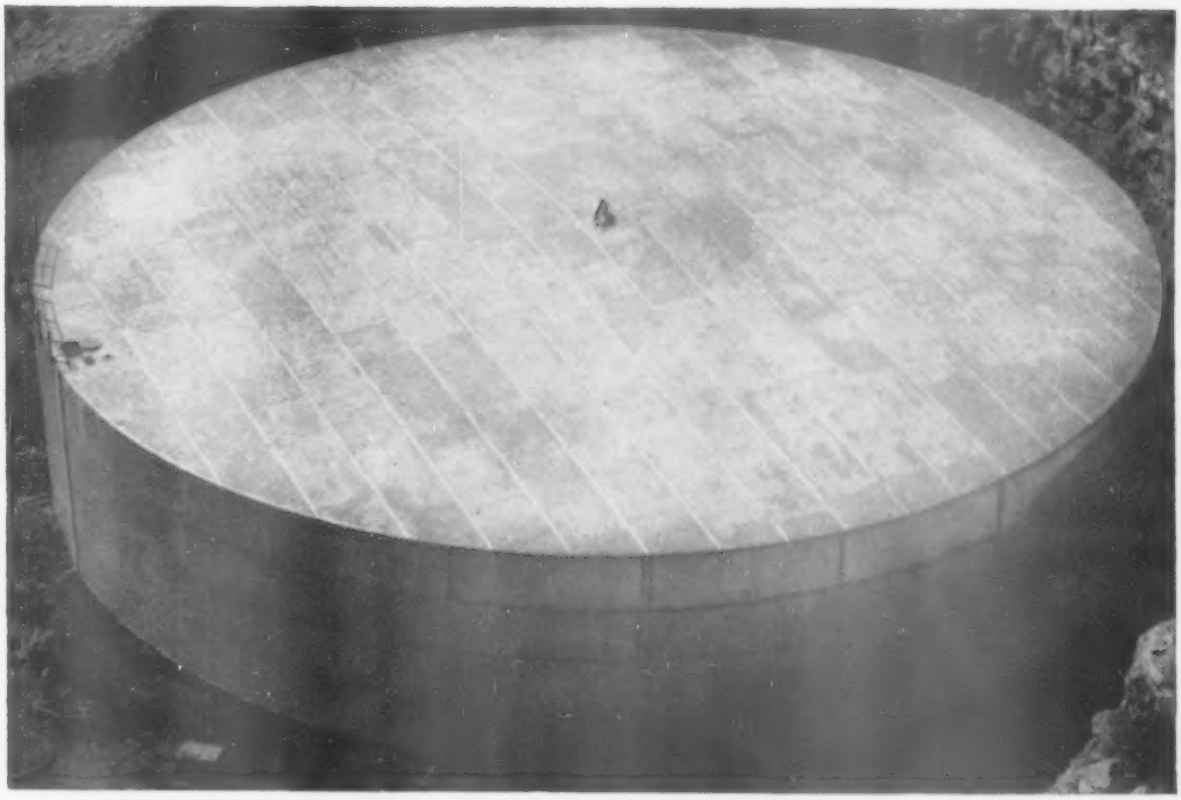
THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY



Constructed entirely of Alcoa Aluminum, world's largest all-aluminum tank* stores 2⅓ million gallons of ammonium nitrate

High resistance to the corrosive action of ammonium nitrate was a big factor in choosing ALCOA Aluminum for the world's largest all-aluminum storage tank. The Mississippi River Chemical Company's primary consideration in erecting the giant tank was the need for uninterrupted storage service with a minimum of maintenance. ALCOA Aluminum's natural resistance to weathering and ammonium nitrate corrosion assured the company of long service with low maintenance costs.

ALCOA Aluminum is used extensively throughout the chemical and petroleum industries to handle many corrosive solutions. This economical metal has a proven record of long, trouble-free service in tank cars, piping, drums, prilling towers and storage tanks.

Write today for detailed information on how ALCOA Aluminum can be used effectively in your operation. Take advantage of ALCOA's more than 30 years of experience with aluminum in hundreds of applications. Send for the new, 80-page book, *Process Industries Applications of Alcoa Aluminum*. It contains the latest performance and design data on ALCOA Aluminum. Write on your company letterhead or use the coupon.

* World's largest all-aluminum storage tank at the Selma, Missouri, plant of Mississippi River Chemical Company. The tank stands 26 feet high, has a diameter of 128 feet, is constructed of more than 300,000 pounds of Alcoa Aluminum, holds 2⅓ million gallons of 83% ammonium nitrate solution. Field erected by Chicago Bridge & Iron Company, Chicago, Illinois. Designed by Fluor Corporation, Ltd., Los Angeles, California.

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ALTERNATE SUNDAY
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SEE YOUR NEWSPAPER
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Please send me your new FREE book, *Process Industries Applications of Alcoa Aluminum*.

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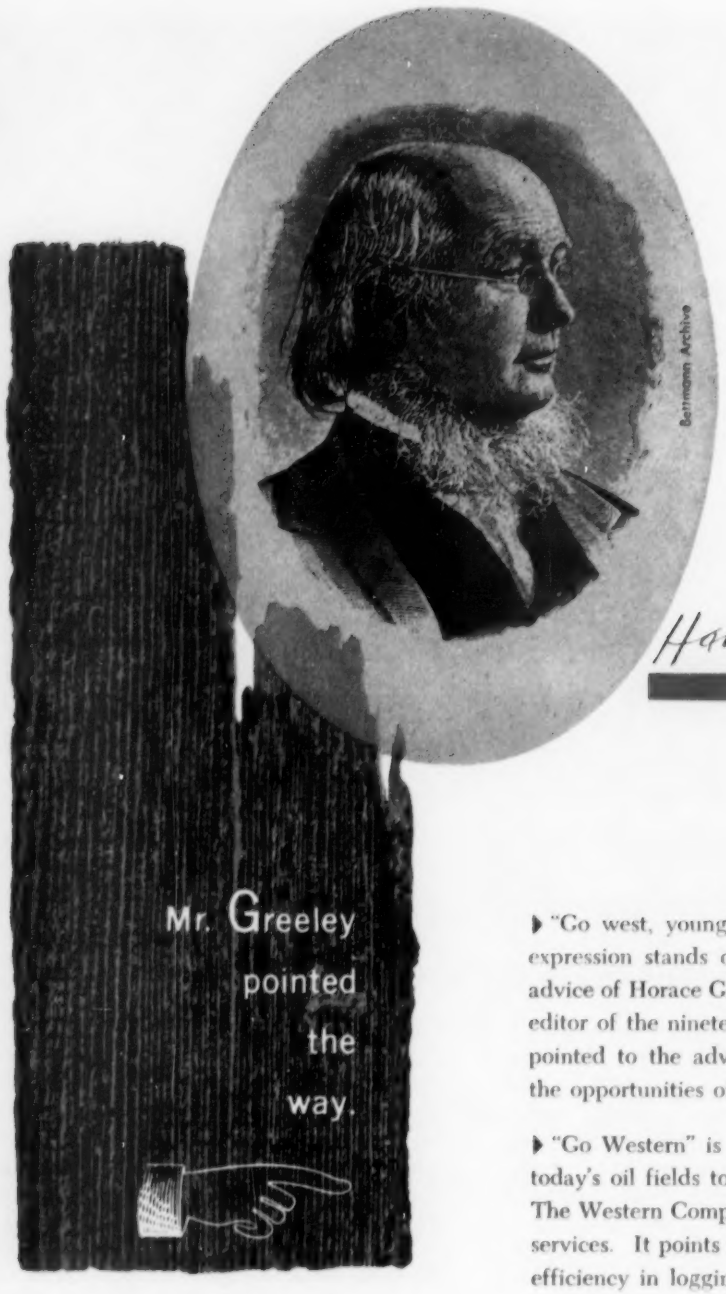


GO WESTERN

▸ "Go west, young man; go west!" This expression stands out in history as the sage advice of Horace Greeley, famous newspaper editor of the nineteenth century. It pointed to the advantages of the west and the opportunities of the day.

▸ "Go Western" is the expression used in today's oil fields to signify the advantages of The Western Company well completion services. It points the way to greater efficiency in logging, perforating, fracturing and acidizing.

▸ Next time, GO WESTERN!

WESTERN Engineered WELL SERVICES

engineered well services

THE WESTERN COMPANY

general offices: Midland, Texas

Texas: Odessa, Seagraves, Levelland, Snyder, Lubbock, Borger / Oklahoma: Lindsay, Healdton, Okla. City / New Mexico: Hobbs / Kansas: Ulysses, Liberal

Big new rig for customer in trouble shipped five hours after order!

This happened recently in Louisiana. The pressure in a 12,000-ft. well blew from below like a volcano and cratered the rig. By 4:00 p.m. that day, the contractor had surveyed the damage and was on the phone to National Supply's New Orleans office. "How fast could you deliver a new rig?"

Our 103-station teletype system hummed. At 7:00 the next morning, we told him we could deliver a National 130 rig—second largest rig in our line—from stock. Four hours later, the customer ordered. Just before 4:00 that afternoon, the big new rig was loaded on a trailer truck and on its way.

Obviously, we were lucky to have such a large rig in stock at that moment. We cannot guarantee to repeat this rapid performance on call. But we *do* guarantee—and this goes for all of the many quality products available from National—service as fast as the National "team" can give it.

We'd like you to know more about this National Supply team—even if your oilfield needs may not be great and top speed very essential. It's made up of six plants, 126 strategically-located supply stores and, most important, 10,000 experienced people working to give you the best in oilfield supply service. See us or call us for action soon, and we'll prove it to you.

THE
NATIONAL SUPPLY
COMPANY

← TWO TYPES TO

SPANGWELD

DRILL PIPE

- Joints flash-welded to drill pipe
- Streamlined exterior contour
- Threaded elements reduced
- Sizes for every drilling requirement, including slim hole operations

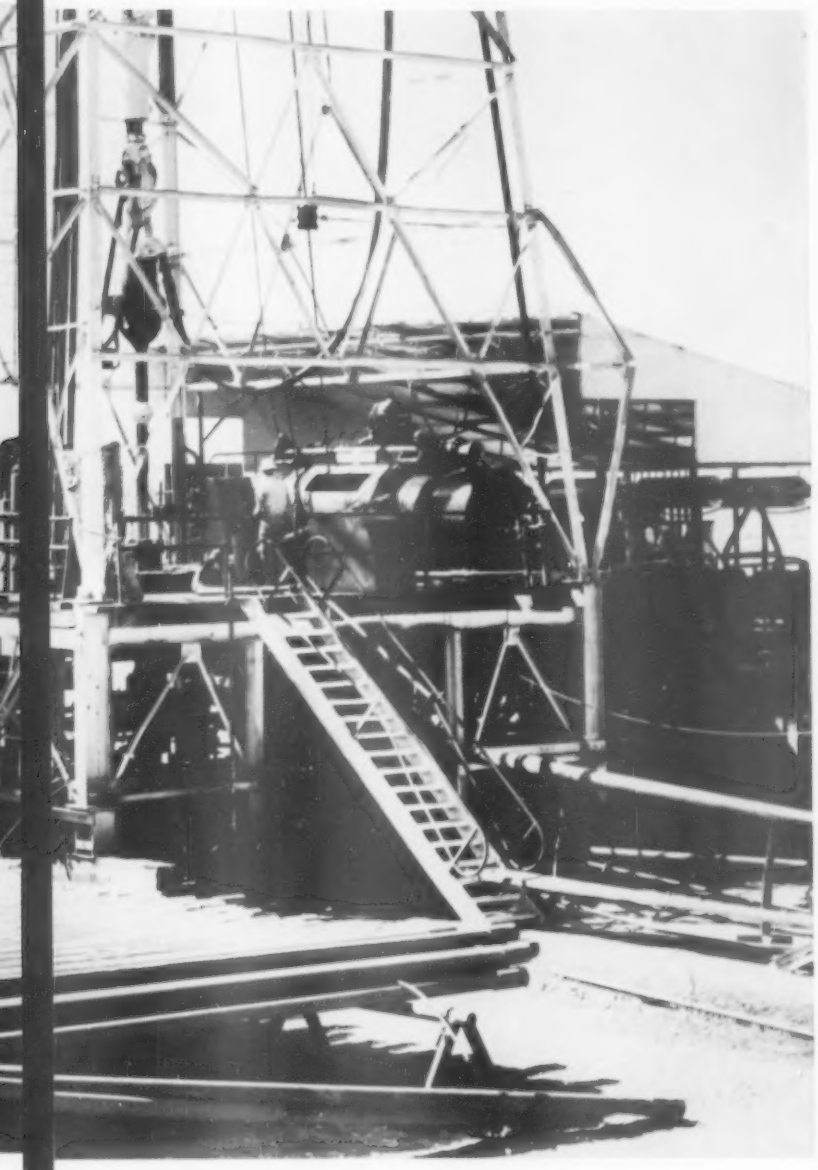
Guard against drill pipe failures with

If the severe stresses and pressures of deep well drilling have caused costly drill pipe failures in your operations, you'll find it profitable to use these top-quality SPANG Tubular Products. Developed to withstand hard service, both Spangweld and SPANG Double Seal Shrink Thread Drill Pipe are highly resistant to fatigue, tension and corrosion* failures.

You can see the reasons for this stamina by examining both types of tool joints. Streamlined Spangweld Drill Pipe has only one-third of the number of threaded elements in conventional drill pipe and tool joints. In SPANG Double Seal Shrink Thread tool joints, two precision metal-to-metal seals eliminate leakage and washouts and prevent fluid entry into the threads. Full broad thread contact in every pipe thread and a root supported by a tool joint thread crest also minimize the effects of fatigue stresses. Whenever necessary, SPANG Double Seal Shrink Thread tool joints can be quickly replaced at the rig.

For highly abrasive service conditions, both Spangweld and SPANG Double Seal Shrink Thread tool joints are available with several types of hard facing. All of these quality features are outstanding reasons why you get maximum protection against failure when you specify dependable SPANG Drill Pipe.

MEET YOUR NEEDS!



SPANG®

DOUBLE SEAL SHRINK THREAD DRILL PIPE

- Completely seals against internal and external pressures
- Joints rapidly replaced at the rig

*Specify SPANG Plastic Coating for maximum corrosion resistance!

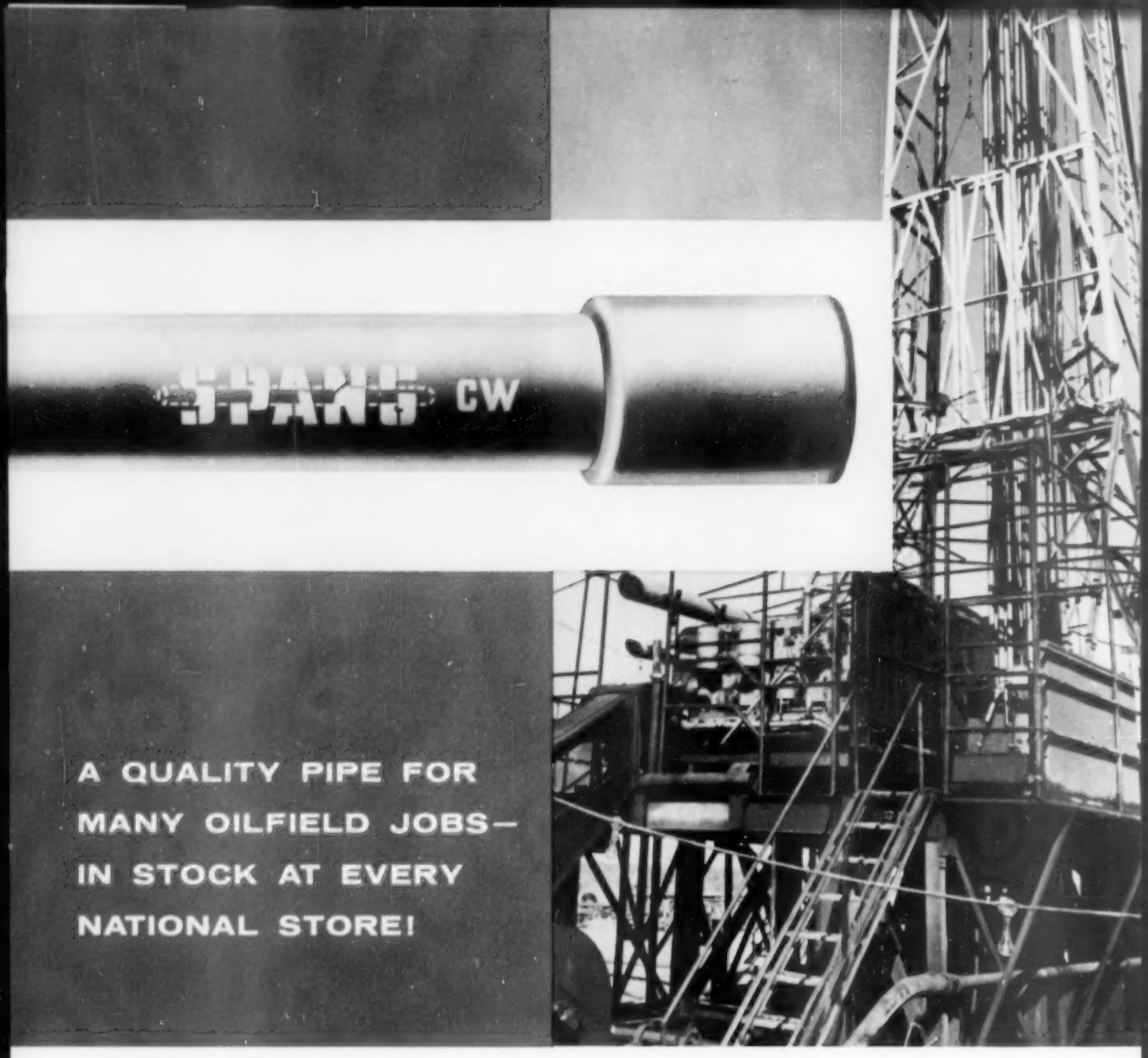
After carefully-controlled shot-blasting and cleaning operations, a tough epoxy-phenolic internal surface coating is applied by alternate spraying and baking. A uniform thickness of not less than .005 inches is the result. Ask the National representative in your area about this service—and any other details you'd like to have about SPANG Drill Pipe.

SPANG® DRILL PIPE!

THE NATIONAL SUPPLY COMPANY

SPANG-CHALFANT DIVISION
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Ft. Worth, Texas; Los Angeles, California; Toledo, Ohio Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

On the next page . . . a top-quality pipe for general service work



A QUALITY PIPE FOR MANY OILFIELD JOBS— IN STOCK AT EVERY NATIONAL STORE!

SPANG CW Steel Pipe is available at every National Supply Store in a full range of sizes—and, most important, there's no extra cost for its special quality.

In countless oilfield applications, SPANG CW has consistently proved itself for dependable general service work. That's because it's made under close quality control conditions—like all the other famous SPANG oilfield tubular products. The manufacturing care behind SPANG CW makes it easy to work with and install. Thorough tests and inspections before shipping insure its top strength and long service life—features that pay off wherever you put it to work.

SPANG CW Steel Pipe is especially useful for waterflooding, air, gas and salt water disposal lines, water and oil gathering systems.

Try it on your next job.

THE NATIONAL SUPPLY COMPANY

SPANG-CHALFANT DIVISION

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.

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NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

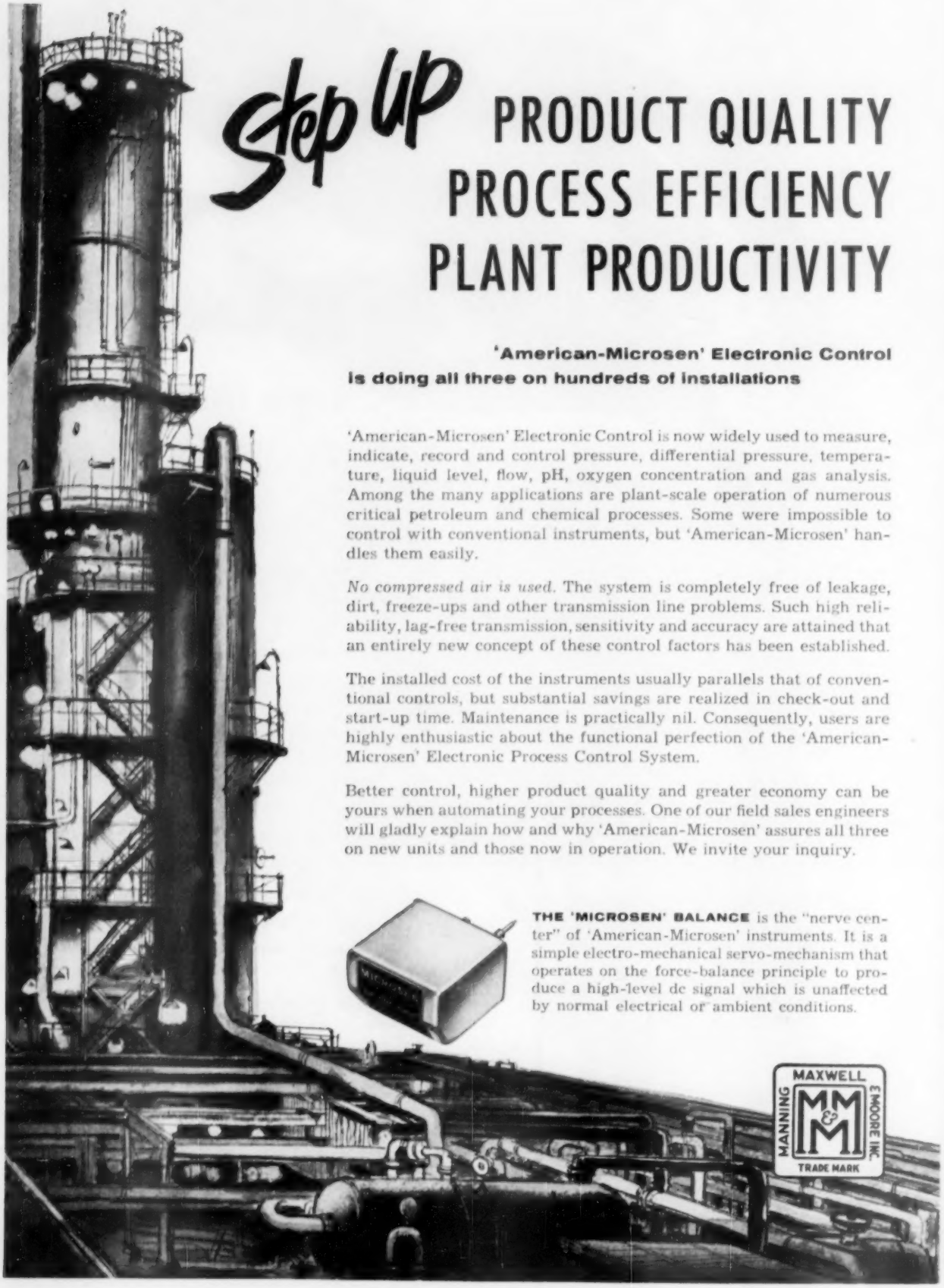
THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION



Step UP PRODUCT QUALITY PROCESS EFFICIENCY PLANT PRODUCTIVITY

'American-Microsen' Electronic Control is doing all three on hundreds of installations

'American-Microsen' Electronic Control is now widely used to measure, indicate, record and control pressure, differential pressure, temperature, liquid level, flow, pH, oxygen concentration and gas analysis. Among the many applications are plant-scale operation of numerous critical petroleum and chemical processes. Some were impossible to control with conventional instruments, but 'American-Microsen' handles them easily.

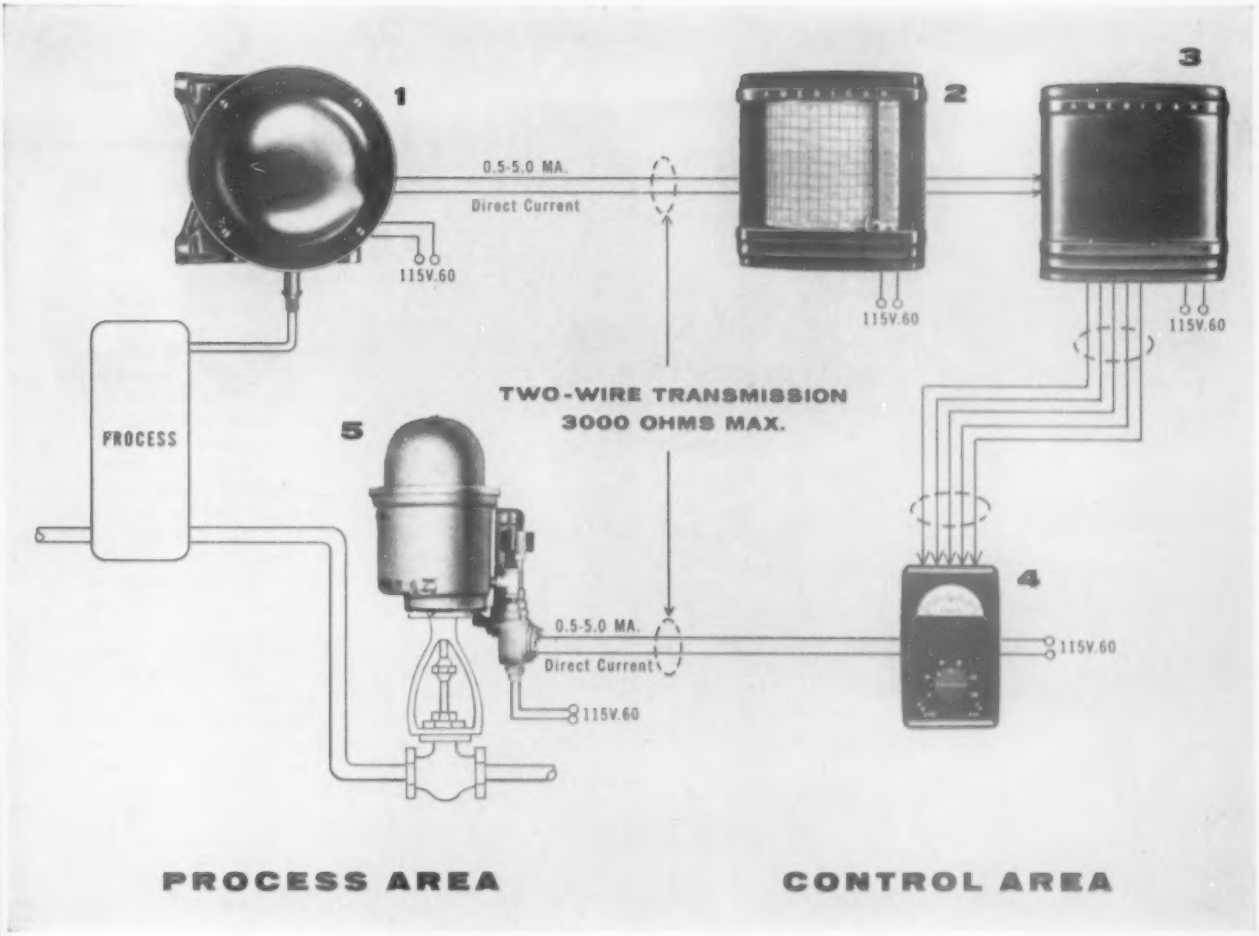
No compressed air is used. The system is completely free of leakage, dirt, freeze-ups and other transmission line problems. Such high reliability, lag-free transmission, sensitivity and accuracy are attained that an entirely new concept of these control factors has been established.

The installed cost of the instruments usually parallels that of conventional controls, but substantial savings are realized in check-out and start-up time. Maintenance is practically nil. Consequently, users are highly enthusiastic about the functional perfection of the 'American-Microsen' Electronic Process Control System.

Better control, higher product quality and greater economy can be yours when automating your processes. One of our field sales engineers will gladly explain how and why 'American-Microsen' assures all three on new units and those now in operation. We invite your inquiry.

THE 'MICROSEN' BALANCE is the "nerve center" of 'American-Microsen' instruments. It is a simple electro-mechanical servo-mechanism that operates on the force-balance principle to produce a high-level dc signal which is unaffected by normal electrical or ambient conditions.

MAXWELL MANNING M&M MOORE INC. TRADE MARK



1. TRANSMITTER

Types to transmit measurements of temperature, pressure, differential pressure, liquid level, flow, pH, oxygen concentration, gas analysis, etc.

2. RECORDING SET STATION

Records on strip chart or card and compares the measured variable with the control point setting. Error signal is transmitted to the Controller. (Indicating Set Stations also available.)

3. CONTROLLER

An electronic amplifier with simple feedback circuits to produce calibrated proportional, reset and rate control actions. (Rate action added by plug-in unit.) Resulting control signal is fed to the Manual Control Station.

4. MANUAL CONTROL STATION

Permits switching from automatic to manual valve operation during start-up or emergency conditions. Bumpless transfer from manual back to automatic operation is built into the instrument. Retransmits control signal to Electro-Hydraulic Control Valve Operator.

5. ELECTRO-HYDRAULIC CONTROL VALVE OPERATOR

A power unit with position feedback that operates slip-stem valves. Completely eliminates need for compressed air. Mountable on standard yokes supplied with conventional slip-stem control valves with bodies of single or double-seated construction, with V-port, parabolic, needle and equal percentage plugs.

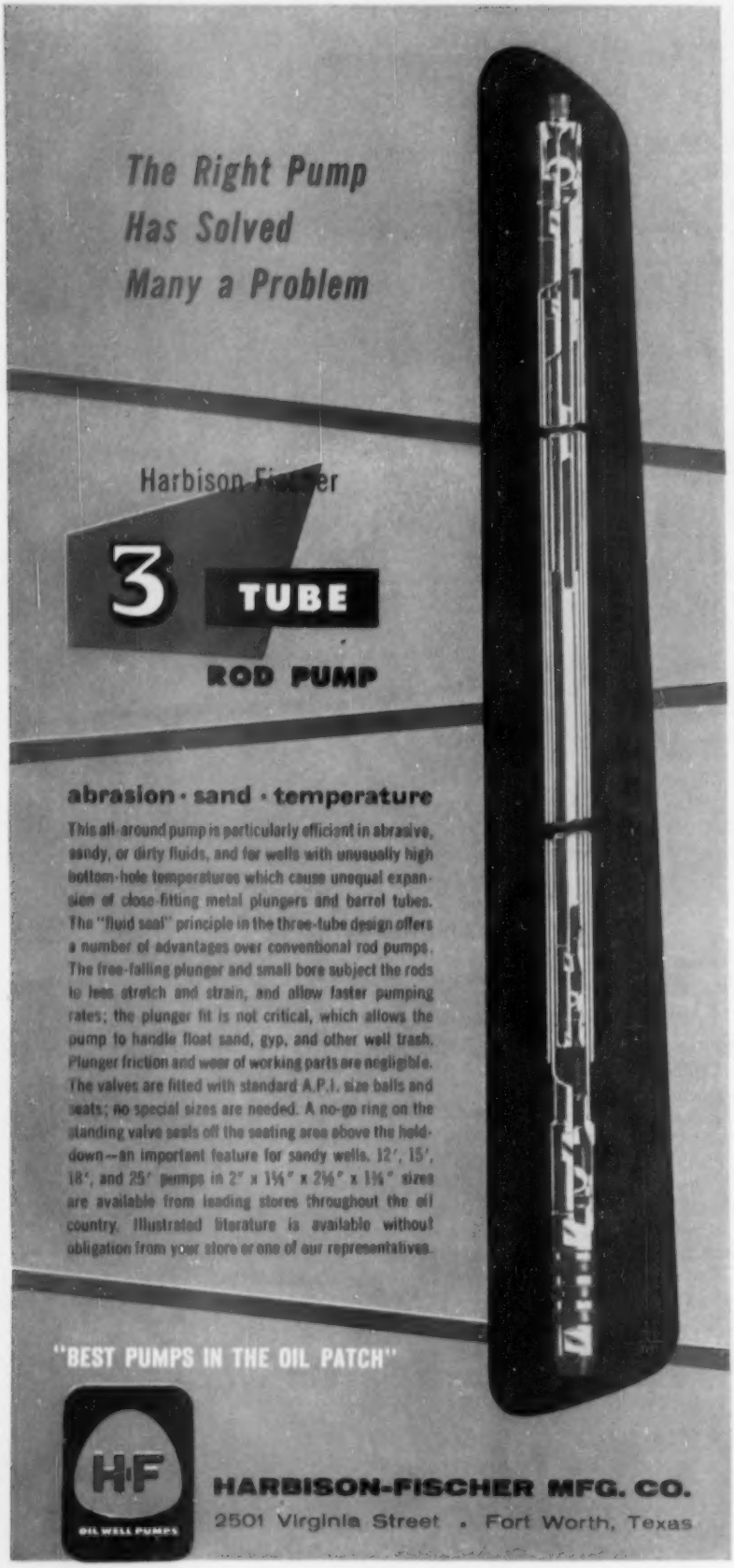
Other components available to meet specific installation requirements.

MANNING, MAXWELL & MOORE, INC.

INDUSTRIAL CONTROLS DIVISION

Stratford, Connecticut

MAKERS OF 'AMERICAN MICROSEN' ELECTRONIC TRANSMITTERS, INDICATING OR RECORDING SET STATIONS, CONTROLLERS, MANUAL CONTROL STATIONS, ELECTRO-PNEUMATIC VALVE POSITIONERS AND ELECTRO-HYDRAULIC CONTROL VALVE OPERATORS.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Has Solved
Many a Problem
Harbison-Fischer
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ROD PUMP
abrasion · sand · temperature
This all-around pump is particularly efficient in abrasive, sandy, or dirty fluids, and for wells with unusually high bottom-hole temperatures which cause unequal expansion of close-fitting metal plungers and barrel tubes. The "fluid seal" principle in the three-tube design offers a number of advantages over conventional rod pumps. The free-falling plunger and small bore subject the rods to less stretch and strain, and allow faster pumping rates; the plunger fit is not critical, which allows the pump to handle float sand, gyp, and other well trash. Plunger friction and wear of working parts are negligible. The valves are fitted with standard A.P.I. size balls and seats; no special sizes are needed. A no-go ring on the standing valve seats off the seating area above the hold-down—an important feature for sandy wells. 12', 15', 18', and 25' pumps in 2" x 1¼" x 2½" x 1¼" sizes are available from leading stores throughout the oil country. Illustrated literature is available without obligation from your store or one of our representatives.
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They Say—

History Repeating?

"It would be most unfortunate should the present (Long Beach) Harbor Commission take too lightly the idea of cutting down oil production to decrease subsidence.

"Harbor commissioners took that attitude 10 years ago. At that time they were told by the Navy that subsidence would be serious unless waterflooding was resorted to. No action was taken then and the result is millions of dollars have been wasted which might otherwise have been saved and the land is sinking at the rate of 18 in. a year. In their meeting (April 30) the commissioners did not indicate their intention to curtail production in an effort to overcome the problem.

"The Hudson report estimates a possible total drop of 72 ft. It is now 22 ft. at the Edison plant.

"There is a natural tendency for Harbor Commissioners to produce oil at maximum quantities. It gives them more money to use on many projects, but that production has been responsible for sinking a large portion of the city. It is a fact that the city now slants from a subsidence of 18 in. at Anaheim and American to 22 ft. at the Edison plant. That means every structure built on subsided land is slightly tilted.

"A severe earthquake could cause great damage because of stresses caused by the tilting . . . Anyone who reads the Hudson report—prepared for the State Assembly Interim Committee—must be alarmed over the future prospects under present production.

"Whether or not to curtail production deserves a great deal more consideration than it is getting."

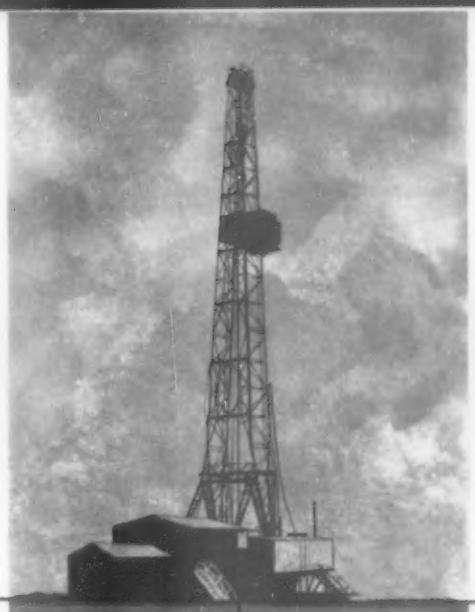
Editorial, Long Beach (Calif.) Independent.

Competition Sustained

"We are pleased that the Court of Appeals has sustained the validity (in the 'Detroit case') of the position we have maintained over the years. To have done otherwise would have established a principle that would seriously injure the competitive system which the Supreme Court has said is the heart of our national economic policy.

"Since the significance of this long litigation has been misunderstood in some quarters, it may be helpful to refer briefly to the Supreme Court opinion in 1951. In that decision the

GO DEEP



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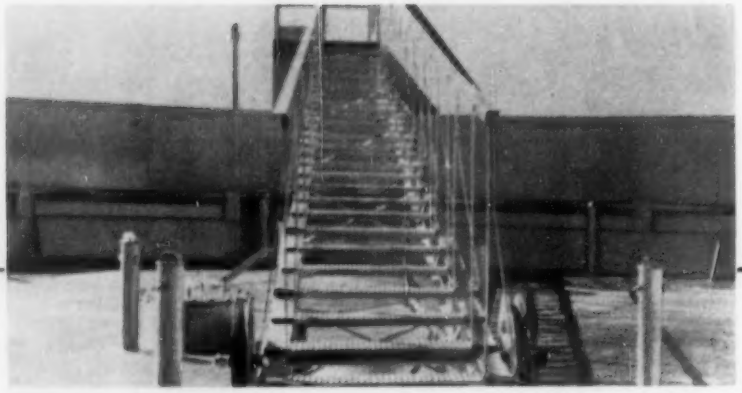

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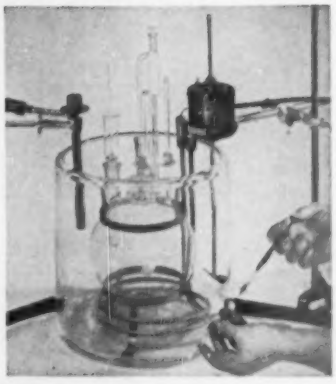
A new instrument which measures volume of vapor produced by a unit volume of liquid. Also determines molecular weights by an adaptation of the Victor Meyer method. Vapor equivalent determinations can be made of residues from natural gas samples, or of any liquid with a vapor pressure of more than 4mm. at the temperature of the vaporization bulb. Unit is compact, mounted within a glass constant temperature bath. Unit consists of a vaporization bulb with an integral multiplying manometer and a removable sample entry system consisting of an orifice and matching pycnometer. Bath is equipped with an electric heater.



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Supreme Court's philosophy is summed up in these two sentences:

" 'The heart of our national economic policy long has been faith in the value of competition . . . It is enough to say that Congress did not seek by the Robinson-Patman Act either to abolish competition or so radically to curtail it that a seller would have no substantial right of self-defense against a price raid by a competitor.' "

Thomas E. Sunderland, general counsel and director of Standard Oil Co. (Ind.) commenting on Court of Appeals decision in "Detroit case."

More Imagination

Dear Sir:

Dr. Levorsen's article in the current Oil and Gas Journal *(April 30, page 104)* is very interesting. We need more like it.

But how, in the name of all exploration, can you pass a statement that imagination is a handicap to a geophysicist! A geophysicist without imagination is lost in any area except the simplest, most obvious structure, and these have been pretty well exhausted by now.

Richard H. Hopkins
Sun Oil Co.
Beaumont.

Dim View on Price Hike

"It is true that the costs of labor and materials have increased materially since the last general crude price increase in 1953 and costs are going up also because of deeper drilling and the extension of operations to areas lying offshore in the ocean. However, the supply situation, on the basis of the law of supply and demand, does not appear now to indicate that a price adjustment for crude oil is likely this year."

R. G. Follis, chairman of Standard Oil Co. of California in statement to company stockholders.

Job for Everyone

"Ignorance is always dangerous and none more so than this ignorance about the actions, motives, and economic effects of business. Replacing it with the truth should be the concern of all businessmen.

"How is that to be done?

"It seems to me . . . that businessmen have the specific responsibility for seeing that members of Congress know what makes business tick. The business organizations and industrial plants of a state or a congressional district are vital to the areas, and are entitled to proper representation by legislators. But these men and women must have

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- **AIR CYLINDERS**
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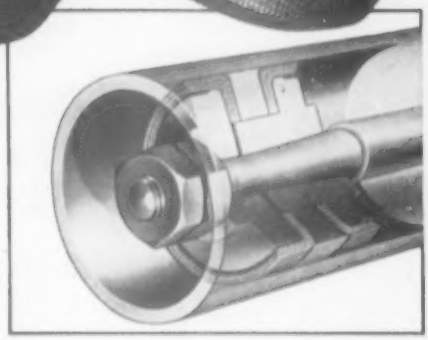
Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing . . and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

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To handle unprecedented high pressures, OCT has developed a pressure gauge needle valve that features a one-piece alloy steel body, a welded bonnet for maximum safety, and a multi-compound, non-crushable V-type packing especially developed to withstand extremely high pressures and temperatures.

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knowledge and background to provide such representation.

"As individuals, ask your Congressmen and Senators to visit your plants and offices. Show them what you make or do, and explain the economic and social importance of it to your community. If they are good lawmakers, they will ask questions, and, in their own way, reach a better understanding of your aims and problems."

M. J. Rathbone, president, Standard Oil Co. (N. J.), in address before Newark Rotary Club, Newark, N. J.

Some Kind Words

Dear Sir:

I have just received the exploration number of the Journal (April 30) and must compliment you heartily on it.

It represents a comprehensive and significant contribution to the problems of exploration today.

Bernard H. Lasky
Engineer and Geologist
3333 Charleston Circle
Houston, Tex.

Science and Economic Growth

"Science today may well be the most important single cause of economic growth. During the postwar period, for example:

"... **Spending on research** has grown on the average 10 per cent a year.

"... **Our stock of scientists** and engineers has grown 6 per cent a year.

"... **And output per man-hour,** as a result, has grown nearly 3 per cent a year—which is considerably above the long-run average of 2.2 per cent."

Report from Business in Brief, quarterly publication of Chase Manhattan Bank.

CALENDAR OF EVENTS

MAY

29-June 1 Institution of Gas Engineers, London.

30-June 1 Texas College of Arts & Industries, eleventh annual short course in Gas Technology, Kingsville, Tex.

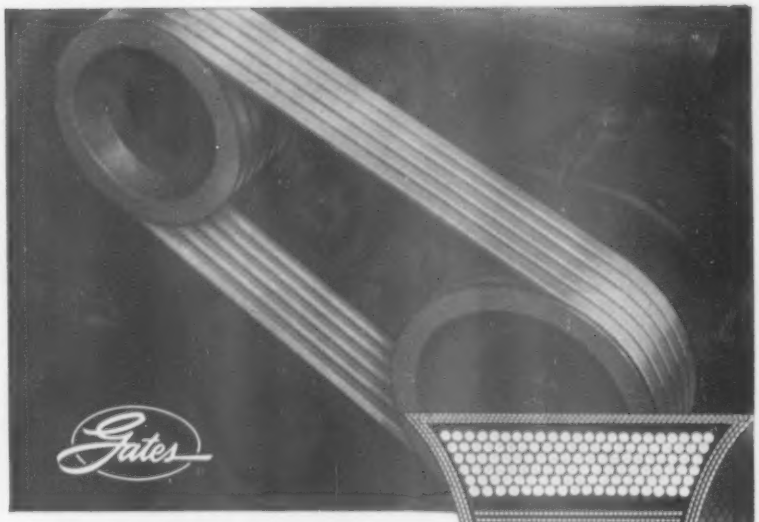
30-June 2 Interstate Oil Compact Commission, Dallas.

JUNE

3-8 Society of Automotive Engineers, summer meeting, Chalfonte Haddon Hotel, Altantic City, N. J.

6-7 Independent Oil Men's Association, annual convention, Statler Hotel, Boston.

6-8 American Society for Quality Control, tenth annual convention, Palais du Commerce, Montreal.



Concave sides make V-belts last longer

The sides of every Gates V-belt (Fig. 1) are concave—a precisely engineered curve that greatly increases V-belt life. Here's why:

On the bend around the sheave, the concave sides of a Gates V-belt fill out and become straight (Fig. 1-A). Thus the belt makes full contact with the sides of the sheave, grips the sheave evenly, and wear is distributed evenly across the sides of the belt. Uniform wear lengthens belt life; keeps costs down.

Make this simple test

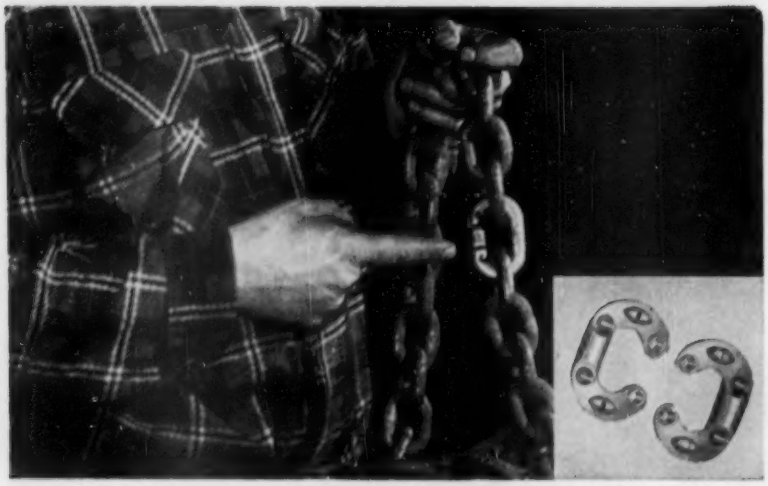
Take a straight-sided belt (Fig. 2) and bend it. Feel the sides at the bend; they bulge out. Now picture this bulge in the sheave groove (Fig. 2-A). It is easy to see that the belt makes uneven contact at points indicated by arrows. Naturally, wear is greater at these points. Uneven wear shortens belt life; increases belt costs.

Cut down-time and V-belt replacement costs. Specify belts that grip evenly and wear longer . . . specify Gates Vulco Rope—the V-belt with concave sides. There is a Gates distributor nearby who will quickly supply the belts you need. The Gates Rubber Co., Denver, Colorado

—World's Largest Maker of V-Belts

TPA 66

Gates VULCO ROPE Drives



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Actually stronger than proof-coil chain, famous Laughlin genuine "Missing Links" give an added element of safety on the job to men and equipment. Safety-conscious contractors say, "For safety's sake, we always specify Laughlin, the world's strongest split connecting link." Drop-forged from special forging steel and heat-treated, Laughlin genuine "Missing Links" are matched under pressure for a perfect fit. They are available in a complete range of sizes $\frac{7}{16}$" to $1\frac{7}{8}$" at distributors everywhere.

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Working efficiently means working safely. Two products designed for safety as well as efficiency—genuine Crosby Clips and Load-Rated Crosby Blocks—are helping set safety records

on projects across the country. Long-recognized as industry's safest clips, Crosby Clips, with the famous Red-U-Bolt, are specified by more construction firms than any other drop-forged wire rope fasteners.

To safeguard men and equipment, Load-Rated Crosby Blocks have the safe working capacity of each block embossed right on the sideplates. To help keep your jobs safer, insist on genuine Crosby Clips and Crosby Blocks . . . products of the Crosby Products Division, American Hoist & Derrick Co., St. Paul 1, Minnesota.

THE PERFECT COMBINATION

Maximum strength without the brittleness that can cause fracture under shock load—the result of a perfect combination of design, steel and drop forging used in Laughlin Shackles. Hefty pins are forged from the same quality steel. Your Laughlin Distributor has shackles in $\frac{3}{16}$" to 3". sizes!

RIGGERS WANT SAFETY HOOK

Jobs where one miscue can endanger men and equipment require the safest possible equipment. To prevent loads jarring from the hook—a major cause of accidents—safety leaders specify Laughlin Safety Hooks. Drop-forged Laughlin Safety Hooks are equipped with a powerful, easy-to-operate snap spring latch that guarantees loads cannot slip or jar from the hook and prevents overloading the hook with too many lines. Here's another safe, efficient Laughlin product from the world's most complete line of fittings in all sizes for wire rope and chain. For complete catalog, write: Thomas Laughlin Division, American Hoist & Derrick Co., St. Paul 1, Minnesota, or Portland, Maine.

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On suction lines handling rotary drilling mud, DeZurik Easy Operating Plug Valves remain in hard service month after month . . . *despite* pulsation and vibration!

The dead-tight seal of the rubber-faced plug and metal valve seat is not affected by line surge or valve strain. The plug won't distort or stretch.

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7-8 American Petroleum Institute, Oil Industry Information Committee, Conrad Hilton Hotel, Chicago.

10-15 American Petroleum Institute, Production Division midyear standardization conference, Brown Palace and Cosmopolitan Hotels, Denver.

11 American Gas Association and Independent Natural Gas Association of America, joint meeting of rate committees, Shamrock Hilton Hotel, Houston.

11-15 American Institute for the Advancement of Science, Gordon Research Conference on Catalysis and Petroleum, Colby Junior College, New London, N. H.

12 A.G.A. rate committee, Shamrock Hilton Hotel, Houston.

13 I.N.G.A.A. rate committee, Shamrock Hilton, Houston.

13 Pennsylvania Grade Crude Association, thirty-third annual meeting, Bradford, Pa.

14-16 American Society of Mechanical Engineers, applied mechanics conference, University of Illinois, Urbana, Ill.

14-16 National Oil Scouts and Landmen's Association, thirty-third annual convention, White Plaza Hotel, Corpus Christi, Tex.

17-21 American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Cleveland.

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

17-23 World Power Conference, Vienna

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

21-23 American Association of Petroleum Landmen, annual convention, Denver.

25-29 American Institute of Electrical Engineers, 1956 summer and Pacific general meeting, San Francisco.

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

JULY

9-11 American Gas Association, American Petroleum Institute, Canadian Petroleum Association, committees on natural gas reserves, Banff, Alta.

17-27 Program on Recent Advances in Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

18-20 Yellowstone-Bighorn Research Association, third Professional Short Course on Uranium Occurrence and Structural Geology, Red Lodge, Mont.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

20-21 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

5-7 Wyoming Geological Association, eleventh annual field conference, Jackson Lake Lodge, Moran, Wyo.

9-12 Independent Natural Gas Association of America, annual membership meeting, St. Anthony Hotel, San Antonio, Tex.

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

12-14 National Petroleum Association, an-

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nual meeting, Traymore Hotel, Atlantic City, N. J.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th annual meeting, Atlantic City, N. J.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

2-4 National Association of Corrosion Engineers, south central region, Beaumont.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Hintington Hotel, Pasadena, Calif.

14-20 OIL PROGRESS WEEK.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-Nov. 1 Society of Exploration Geophysicists national convention, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, fall meeting, Ambassador Hotel, Los Angeles.

12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

JANUARY (1957)

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

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When you want to put them in fast and be sure they'll last, you won't go wrong doing a pipeline job like this. The illustration shows work in the last 10-mile link in a network that now brings natural gas all the way from the Gulf Coast of Louisiana to Washington County, Pennsylvania — a distance of over 1,000 miles.

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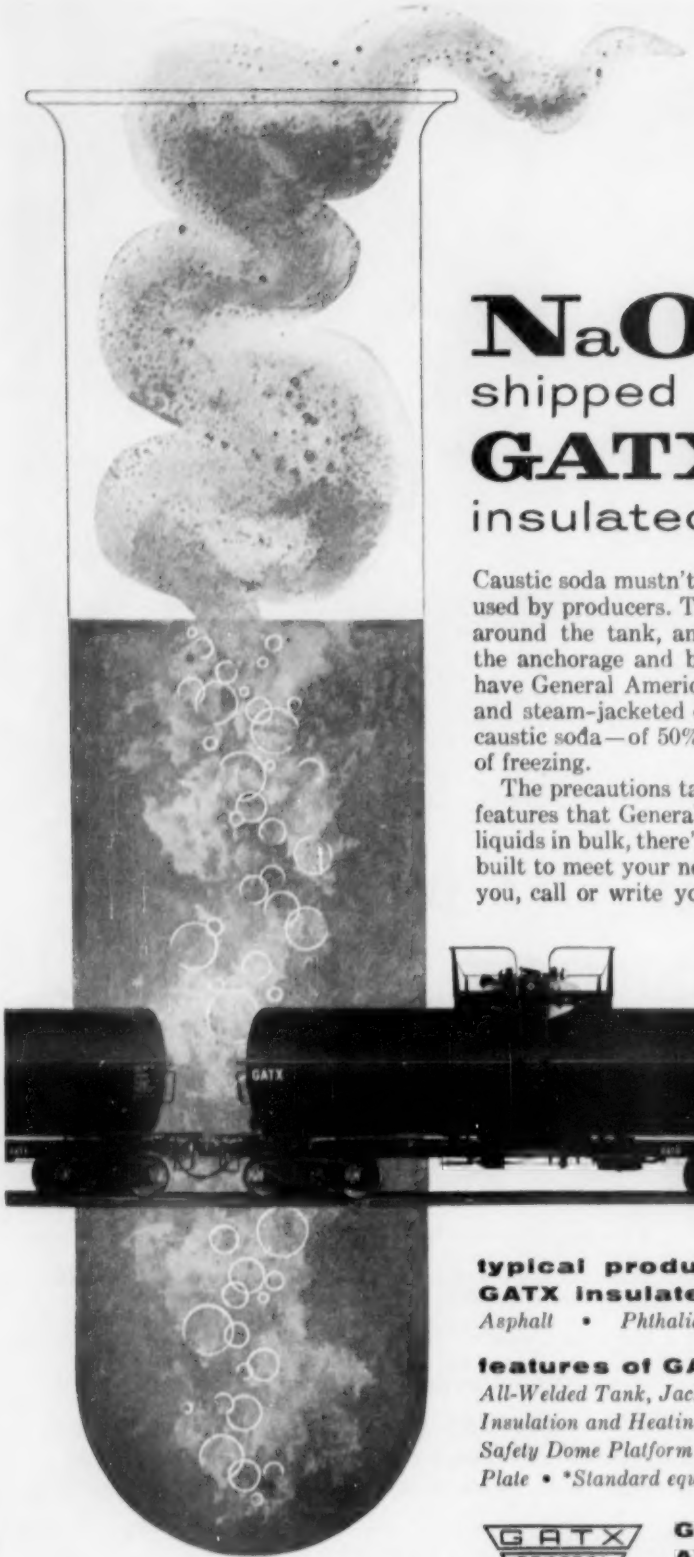

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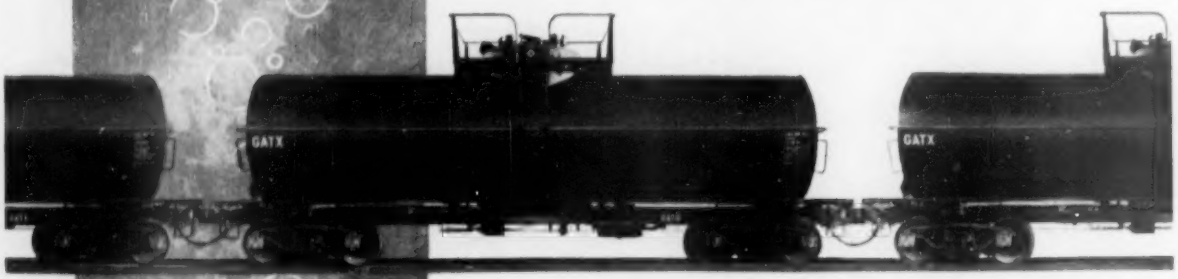
The precautions taken to protect caustic soda are typical of the features that General American builds into tank cars. If you ship liquids in bulk, there's a General American car that's built or can be built to meet your needs. To learn how GATX tank cars can help you, call or write your nearby General American district office.



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JOURNALLY SPEAKING . . .

Oil Men's Revelry

WE attended an oil men's banquet the other evening. Eastern politicians and left-wing columnists will be glad to know that it lived up to the best traditions they have laid down for such affairs.

At several bars the cocktails flowed freely. Tables groaned with their loads of fancy hors d'oeuvres and rare delicacies. A strolling accordionist made music for the predinner revelers. The banquet itself included the choicest prime roast beef, and everything else was the finest within the power of the city's leading hotel. For entertainment there were an orchestra, singers, dancers, jugglers, and other professional acts imported from another city. It was truly a gala affair, with no expense spared—exactly as some people have been led to believe is the case with every gathering of "oil-rich millionaires."

Only, the guests didn't look like oil-rich millionaires. They looked more like truck drivers, pumpers, pipeline walkers, clerks, accountants, welders, mechanics, refinery workers, and the sort of folks you see at the movies or at a P.-T.A. meeting.

Which is what they were. This was the annual dinner given by an oil company for the people who have been in its employ for 25 years or more. There were more than 500 of them, and some have been with the same company for 40 years, indicating that they don't think the oil industry is such a bad place to work. Very, very few of them hold top-echelon positions. The great bulk represented a cross-section of just the ordinary folks it takes to run the business. Not a magnate or tycoon in the bunch.

And (and this will surprise some of the industry's detractors) everyone of the guests at this festive board has lived all his life on a straight salary—not one of them has any oil wells in his back yard and not one of them gets any of that much-maligned "depletion allowance" off his income tax.

Our personal enjoyment of the evening (we were specially invited as a member of the press) was marred by pondering this perplexity: Why is it that the American public's conception of the oil industry seems to be wholly that decribed in the first two paragraphs above and to the complete exclusion of consideration of the facts as related in the three subsequent paragraphs?

Times Have Changed

ANOTHER thing impressed us at that company dinner for old timers to which we were invited. That was the fact that the list of people given 30-year awards was twice as long as the list of people with 25 years of service.

At first glance that seemed odd. You would think that it naturally would be the other way around. Then we counted back and discovered that 25 years ago was 1931. That was just about the bottom of the Great Depression, and the oil business had been in a bad way for several years before that.

Not many people were being hired by oil companies or any other business in 1931. Most companies were laying off employes. When a man left for work every morning his chief thought was whether that would be the day he received the dreaded pink slip. The more we thought about it the more we marveled that so many people managed to get jobs and keep jobs with that company during the depression and to stay on to get 25 and 30 year pins in 1956. They must have been pretty good workers.

We couldn't help contrasting those days with the present. This year's high-school and college graduates don't have to pound pavements looking for jobs. Oil companies and others send out scouts to recruit them. They are enticed with big starting salaries, promotion schedules, fringe benefits, and retirement annuities.

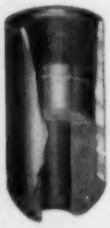
In fact, we have been told that the first question most prospective employes ask is "How much pension do I get at 65?" The old timers at this awards dinner never asked that question in 1931. They were thankful for their daily bread.

We got to wondering whether the youngsters who condescend to accept positions under today's conditions will be as willing to work hard and as eager to keep their jobs as the old timers we saw around us. O tempora! O mores! Thoughts like that nearly ruined our enjoyment of the evening.

—Henry D. Ralph.

BAKER IS "STILL "FIRST"...

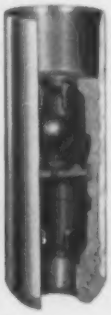
This is Product No. 100—Baker Cement Float Shoe—outstandingly "First" for the safe guiding, floating and cementing of casing. No other shoe can approach its world-wide popularity. Available also in the "whirler" type at a nominal increase in price.



This is Product No. 102—Baker Cement Guide Shoe—used in combination with a Baker Cement Float Collar when one float valve is considered sufficient, and a stop for the cementing plug is desired above the shoe. Also used in combination with Baker FILL-UP Collars or FLEXIFLOW Collars.

This is Product No. 101 M&F—Baker Cement Float Collar, usually positioned just above the shoe joint to provide a "stop" for the cementing plug. Used in combination with any type of Baker Cement Float Shoe, Guide Shoe, or "Whirler" Shoe, selected to meet the customer's specifications.

This is the new Baker Differential FILL-UP Shoe—Product No. 1081—which permits the casing to fill automatically from the bottom (while it is being run) to within 90% of the fluid level of the annulus. By using both the FILL-UP Shoe and its companion FILL-UP Collar, an 81% fill is secured. It's new—ask for brochure.



This is the new Baker FLEXIFLOW Fill-Up Shoe—Product No. 160. This feature is also available in a Collar and a "Whirler" Shoe. Permits the casing to fill automatically from the bottom through a flexible, variable orifice—eliminates messy intermittent surface filling, as well as casing overflow—saves landing time and drilling mud—reduces the damaging "Ram Effect." Ask for brochure describing the new FLEXIFLOW Equipment.

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"FIRST" and ONLY "Whirling" Action provided by baffled side ports in all "whirler" type shoes and collars to wash the formation and then whirl the slurry to aid in perfect bonding of the slurry with the formation.

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"FIRST" in Popularity because you (and thousands of other operators) have recognized tools and methods which provide *dependable performance*. It is both a challenge and an inspiration to work with men who *insist upon results*—a challenge to supply their present needs, and an inspiration to anticipate their demands of tomorrow. Baker will always be ready—"First" with what you need!

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Get to the heart of the imports problem

THE latest imports statement of the Office of Defense Mobilization is a move in the right general direction. But ODM must take care not to miss the real objective of the mandate given it by Congress.

It is proper and helpful to make a detailed analysis of oil imports, broken down as to their nature, origin, point of impact, and effect on national security. The common tendency to lump all oil imports together and consider them all injurious is not realistic.

Crude oil and residual fuel should be considered as separate items and, if so indicated, should be treated separately. If accessibility in time of war is a primary consideration, there is justification for differential treatment between oil imports from Eastern and Western Hemispheres. And it is not necessarily illogical to use one for the West Coast and another for the rest of the nation.

THE DANGER IN THIS ANALYTICAL process is that it can be carried to absurd extremes. A microsegmented approach can turn up figures that appear to prove almost anything. Preoccupation with the "trees" can lead to losing sight of the "forest"—the reason for the whole study in the first place.

Some domestic producers feel that ODM has gone to ridiculous extremes already, and has let its studies become a tool for justifying virtually unlimited imports. They fear that if the process is continued it will erode away all hope of any restrictions.

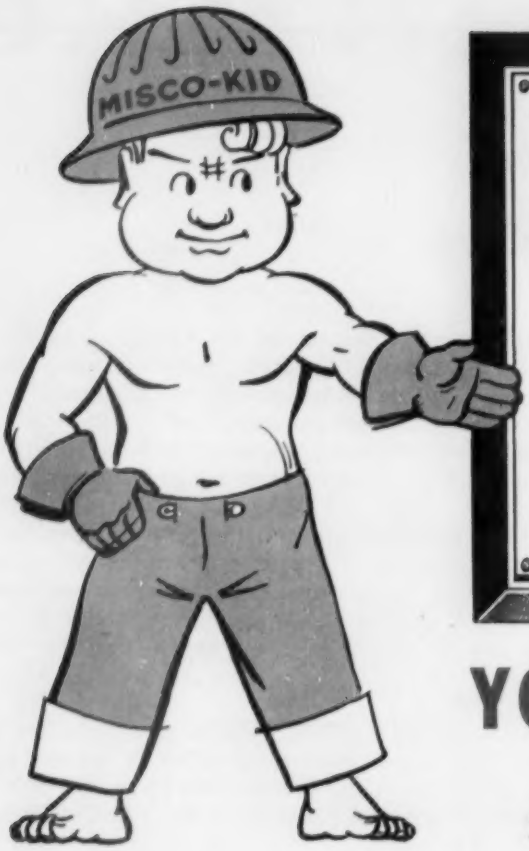
Such a view, however, is not entirely warranted. ODM says that scheduled increases in crude imports are a source of real concern. It calls on certain companies to stop nullifying its program. It has announced a new study and tentatively scheduled a public hearing for the fall.

This may be small comfort for producers who have pocketbook reasons for wanting imports reduced right now, but at least it shows that the problem has not been shunted to dead storage. If the present ODM program is as unsatisfactory as producers believe, certainly a new study offers opportunity to present a new program.

IN THIS NEW STUDY, ODM ought to go straight to the core of its concern with the imports problem. This is the extent, if any, to which imports are impairing the ability of the domestic industry to supply the maximum amount of oil in a national emergency.

That is the real, transcendent, national-defense concern over oil imports. There has been much fuzzy talk about where we will get oil in time of war. We need a clear statement of the problem and a practical formula for working it.

Domestic producers can keep ODM on the right track if, during its current study, they can show it a satisfactory way of measuring—and controlling—the impact of oil imports on the nation's capacity for defense.



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Current and significant in . . .

The Industry This Week

Processing

• **A refinery proposed** in Washington State by Richfield Oil Corp. is getting help in Washington. Special legislation to clear title for a 900-acre site is being considered. Richfield would buy the site from the Tulalip Indians. P. 100.

Biggest refinery column ever built in United Kingdom is being shipped to Shell's new 80,000-bbl. refinery at Cardon, Venezuela. P. 103.

Contract to build first shale oil pilot plant using new Swedish process has been let in Denver. It will be a $100,000, 24-ton-a-day plant. P. 89.

Pipelines

• **ODM is getting protest** over tentative decision not to help build products-pipeline capacity from Gulf Coast to East Coast. American Pipe Line says existing crude lines won't meet refining needs. P. 98.

Two vital issues have been put before U. S. Supreme Court by Panhandle Eastern. Court is being asked to recognize fair field prices and rule whether gasoline extraction is separate operation from pipelining. P. 89.

Plans for a gas system in North and South Carolina have been filed with the FPC. The $21.6-million project is proposed by Trans-Carolina Pipeline. It would bring gas to last large unserved area on eastern seaboard. P. 100.

Industry

• **The oil-industry's steel bill** is going up again in July. A $12 a ton basic increase would be no surprise, followed by a 7 to 10 per cent advance in the price of oil-country products. It could add up to $50 million to industry steel costs the rest of the year. P. 82.

A searching inquiry into politics behind lobbying for the Harris-Fulbright gas bill is getting into full swing again. Spotlight is now turning to testimony in California of Howard Keck, Superior Oil president. P. 88.

Production

• **A new allowable formula** is being sought by Louisiana officials. Second straight cut in state's allowable points up problem. Steady increase in new producing wells and lower seasonal demand have constantly forced older wells to make room for new oil. P. 90.

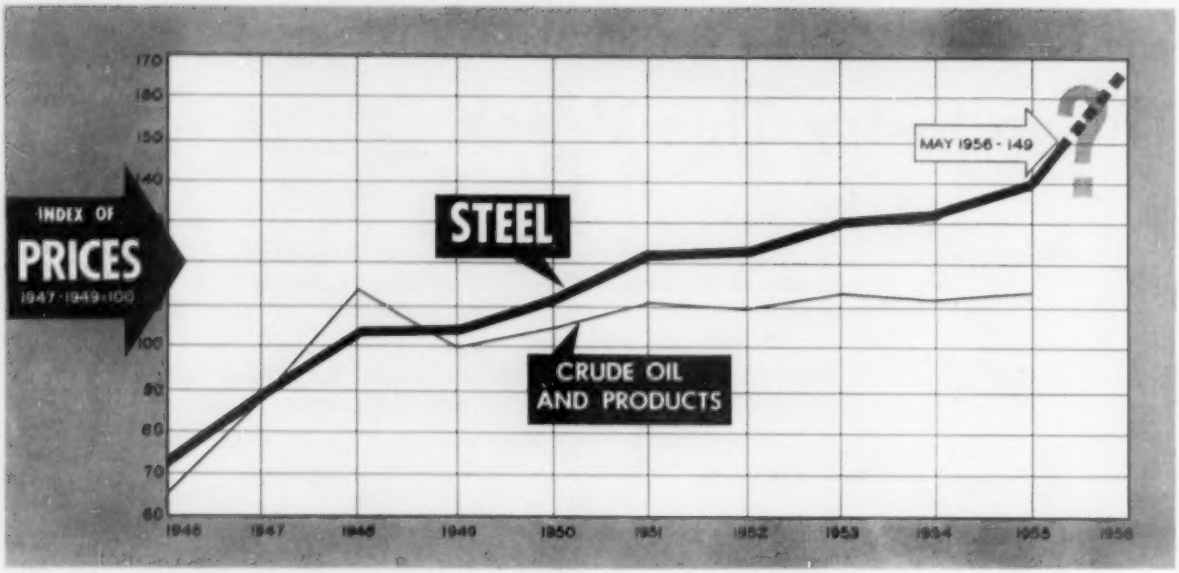
Crude imports will set a new all-time record in June. Companies report they'll bring in 998,500 bbl. daily. P. 84. Imports from Canada averaged 117,521 bbl. daily for first quarter but the upward trend is showing signs of leveling off. P. 92.

Getty Oil is launching a bigger drilling program in the Neutral Zone. Aim is to triple production this year and exploit deeper pay zone. Big part of crude is destined for Tidewater's 130,000-bbl. Delaware City refinery. P. 102.

Exploration

• **An oil show in the Philippines** has been encountered in the first deep test ever drilled in the islands. Philippine Oil Development Co. is drilling the wildcat in the Cagayan Valley of northern Luzon. P. 103. Other foreign notes: Stanvac has spudded its first West Pakistan wildcat . . . W. R. Grace is buying a minority interest in Libyan venture of Texas Gulf Producing. P. 105. . . . And Swiss interests have organized to explore that tiny country for oil. P. 106.

California companies apparently have lost their battle to keep their offshore core-drilling and seismic information confidential. P. 86.



With sizable price increases due, here's . . .

. . . What to Expect from the Steel Hike

YOUR steel bill is about to go up again, and it may go up in a big way.

Oil men have a huge stake in labor talks which steel companies started today. It can be measured in millions of dollars certain to be added to the industry's steel bill the rest of the year.

A year ago the union won a pay boost of 15 cents an hour. Basic steel was raised $7.35 a ton. Oil-country pipe and other steel products needed to find, extract, process, and transport crude oil and natural gas rose 5 to 15 per cent.

This year the union has demanded a package that steel men figure would cost 50 to 60 cents an hour. Demands were keyed to profits, which are running at record levels. Labor cannot get nearly all it asks, nor does it expect to. But suppose the steel companies agree to a contract granting half the demand, or 25 cents an hour.

What will happen to steel prices?

The time-honored ratio of 40 cents a ton increase for each penny in higher wages may go out the window. There is talk instead of a 60 to 1 formula. If the new basis is adopted, a 25-cent boost could mean $15 a ton tacked onto steel prices.

The full increase would no doubt be reflected in the finished products. And with the oil industry using around 2¾ million tons the last half of the year, the steel bill could balloon as much as $50 million.

Individual prices . . . What can we expect in the way of increased prices on various steel products?

The table of prices, and the per cent of increase, shows what effect the $7.35 advance had last summer. The breakdown is offered as a rough basis for figuring what will likely happen when steelworkers' wages go up in July.

Steel is not the only cost element which will be higher.

There will be added labor costs at pipe mills and higher costs of selling a higher-priced item, as was the case a year ago. Rail freight rates are up 6 per cent this year. A new tank built after July 1 will reflect higher shop wages in some areas and higher field wages by this fall.

An increase in basic steel will have different effects on different items. The per-ton manufacturing costs on small-inch tubing, for instance, are far greater than for 36-in. pipe. And how much each item goes up will depend also on the supply-demand picture and competitive conditions.

But all signs point to increases greater than the ones posted a year ago.

Chief interest is centered upon tubular goods and line pipe, which account for almost 80 per cent of the tonnage shipped to the oil industry

A 2 to 12 per cent hike became effective earlier this month on selective sizes and grades of tubing, casing, drill pipe, and line pipe. This "price correction" had nothing to do with the wage increase due in the next union contract. It stemmed from higher costs which steel firms said had not been recognized in prices up to that time.

These changes, for the most part in extra charges for processing, have been made off and on since last fall. Chemical-content extras for carbon special quality bars, wire, carbon rods, and for alloy steels were raised this month also. Width and gage extras for alloy plate and alloy sheet and strip followed earlier boosts in carbon plate and strip, with the increase averaging 1 per cent.

The large-diameter pipe will reflect the actual steel increase more closely, since steel makes up a bigger share of the total cost. Last July the largest pipe had the smallest percentage increase. The smaller the pipe the more it was advanced generally.

In sucker rods, alloy grade rose three times as much as carbon. This pattern will not necessarily repeat itself, however. Some products were increased more than others because the profit margin had dropped too low and supply was tight. Each item is studied separately.

Pumps are in a different bracket from pipe, as far as the effect of a steel increase. The effect is harder to figure, since other materials and many additional factors are involved. Pumps of various types last year increased all the way from 3 to 10 per cent when steel rose 7 per cent.

Tanks and spheres, which take large tonnages, can be expected to reflect

How the Last Steel Boost Affected Oil-Country Products

	June 1955	July 1955	Per cent increase
SUCKER RODS*			
Alloy steel with couplings:			
⅝-in.	$41.42	$47.80	15.4
¾-in.	52.43	60.00	14.4
⅞-in.	67.02	76.90	14.7
1-in.	86.61	100.05	15.5
Carbon-manganese:			
⅝-in.	29.98	31.50	5.1
¾-in.	38.07	39.95	4.9
⅞-in.	48.31	49.90	3.3
1-in.	74.20	75.75	2.1
Carbon:			
⅝-in.	29.32	30.80	5.0
¾-in.	32.46	34.10	5.1
⅞-in.	42.92	45.05	5.0
1-in.	55.29	58.05	5.0
SEAMLESS CASING*			
5½-in. o.d.:			
14-lb. ST&C H40	$114.93	$122.85	6.9
14-lb. ST&C J55	117.88	126.00	6.9
15.5-lb. LT&C J55	134.30	143.73	7.0
17-lb. LT&C N80	163.22	174.91	7.2
17-lb. LT&C P110	204.54	219.19	7.2
7-in. o.d.:			
20-lb. ST&C H40	159.96	171.27	7.1
20-lb. ST&C J55	164.06	175.66	7.1
23-lb. ST&C J55	184.92	198.26	7.2
23-lb. LT&C N80	219.13	234.94	7.2
26-lb. LT&C N80	242.42	260.29	7.4
26-lb. LT&C P110	303.79	326.18	7.4
9⅝-in. o.d.:			
32.3-lb. ST&C H40	258.47	276.74	7.1
36-lb. ST&C H40	280.80	301.16	7.3
36-lb. ST&C J55	288.00	308.88	7.2
40-lb. LT&C N80	379.37	406.86	7.2
47-lb. LT&C P110	558.61	599.09	7.2
53.5-lb. LT&C P110	635.88	681.94	7.2
TUBING*			
External upset T&C:			
2⅜-in. o.d. 4.7-lb. H40	$47.48	$50.92	7.2
2⅞-in. o.d. 6.5-lb. H40	63.88	68.64	7.5
2⅜-in. o.d. 4.7-lb. J55	48.70	52.23	7.2
2⅞-in. o.d. 6.5-lb. J55	65.52	70.40	7.4
2⅜-in. o.d. 4.7-lb. N80	59.90	64.24	7.2
2⅞-in. o.d. 6.5-lb. N80	80.59	86.59	7.4
LINE PIPE*			
Seamless A.P.I. plain end, A or B:			
6⅝-in. o.d. 18.97-lb.	$132.96	$144.00	8.3
8⅝-in. o.d. 24.7-lb.	169.37	183.75	8.5
10¾-in. o.d. 34.24-lb.	238.87	259.00	8.4
12¾-in. o.d. 43.77-lb.	307.12	331.87	8.1
14-in. o.d. 45.68-lb.	322.62	347.70	7.8
16-in. o.d. 52.36-lb.	372.63	401.40	7.7
18-in. o.d. 59.03-lb.	423.32	455.77	7.7
20-in. o.d. 65.71-lb.	466.47	502.60	7.7
24-in. o.d. 79.06-lb.	564.85	596.45	5.6
Electric weld A.P.I. plain end:			
36-in. o.d. 119.11-lb. A or B	$869.43	$917.07	5.5
DRILL PIPE*			
Seamless grade "D" A.P.I. internal upset T&C:			
2⅜-in. o.d. 6.65-lb.	$70.77	$76.34	7.9
3½-in. o.d. 13.3-lb.	139.33	150.47	8.0
4-in. o.d. 14-lb.	145.77	157.50	8.0
4½-in. o.d. 16.6-lb.	172.86	186.76	8.0
5-in. o.d. 19.5-lb.	202.43	218.76	8.1
5½-in. o.d. 21.9-lb.	230.28	248.62	8.0
6⅝-in. o.d. 25.2-lb.	263.87	284.98	8.0
PUMPING UNITS			
A.P.I. 57	$2,343	$2,577	10.0
A.P.I. 114	3,263	3,374	3.4
PUMPS			
4-in. discharge heavy-duty process	$2,114	$2,325	10.0
4-in. discharge light-duty process	627	690	10.0
6-in. discharge heavy-duty (1,200 psi. service pipeline)	19,091	21,000	10.0
TANKS			
100-bbl. welded	$660	$660	
200-bbl. welded	985	985	
500-bbl. bolted	1,455	1,455	
1,000-bbl. bolted	2,245	2,245	
5,000-bbl. bolted	7,385	7,385	
10,000-bbl. bolted	13,300	13,300	
55,000-bbl. (fixed cone roof)	48,000	55,200	15.0
55,000-bbl. (floating roof)	64,500	73,500	10.9
80,000-bbl. (fixed cone roof)	62,600	72,000	15.0
80,000-bbl. (floating roof)	84,000	95,800	14.0
120,000-bbl. (fixed cone roof)	90,300	104,000	15.0
120,000-bbl. (floating roof)	114,100	130,500	14.4
SPHERES			
10,000-bbl. (40 psi.)	$52,000	$59,800	15.0
10,000-bbl. (75 psi.)	72,600	83,300	14.7
15,000-bbl. (40 psi.)	73,000	83,800	14.8
15,000-bbl. (75 psi.)	101,000	116,000	14.9
ROCK BITS			
Three-cone:			
6⅜-6¾-in.	$130	$142	9.2
8⅛-9-in.	168	185	10.0
11⅜-12½-in.	260	290	11.5
Three-cone jet:			
6¾-in.	156.50	170	8.6
7⅞-7⅞-in.	178	196	10.0
10⅝-11-in.	256	282	10.0

*Prices are per 100-ft. mill.

the basic steel increase but the effect will differ widely in different sizes. One big tank builder said he absorbed the last steel increase on 100 to 10,000-bbl. tanks, and so is overdue for a price rise. The builder said he planned to boost his prices the exact amount that steel went up. He had already figured a list based on a 5 per cent increase on all sizes.

The big 55,000 to 120,000-bbl. tanks went up 15 per cent for the most part a year ago. It would take a whopping steel increase to send them up that amount again.

Steel-industry position . . . Some steel men favored a bigger increase last July, but the price leaders balked.

The talk now is starting at $8 a ton as an absolute minimum. It ranges up to $23 a ton, which some companies say is not too high. Two are on record as saying $12 to $15 is within reason. They clamored for an across-the-board steel hike in advance of the labor talks, and expressed regret because the recent boost started by U. S. Steel Corp. did not cover all items.

The steel industry insists that higher prices are essential even if wages don't go up. The reason: The need to build new capacity to catch up with the nation's apparently insatiable appetite for steel.

Demand has risen steadily in our expanding postwar economy. Oil has increased its steel consumption 2½ times in the past 10 years. The steel industry has been growing, too. Production will be up some 3 million tons this year to 120 million, partly because plants are operating at close to 100 per cent of capacity.

Supply situation . . . In spite of in-

creased production this year, steel is expected to continue much tighter than supply firms would like it to be. Business is too good. The job of selling has become a job of rationing, of deciding how much a customer can get along with.

The prospect is for a scramble for steel to continue so long as business remains good. Some building has already been held up for lack of steel. Anyone who failed to foresee drilling or construction needs is out of luck unless he can borrow from someone who has built his inventory to guard against a possible shortage. Pipe is now being booked into 1959, farther ahead than at any time in the memory of the industry.

The mere thought of a steel strike horrifies both steel companies and their customers. It is taken for granted that the steel industry will settle with the union without any work stoppage.

Expansion problems . . . Increased capacity is a must if a real shortage is to be avoided. And there is but one source for expansion capital, steel men contend. That is higher prices.

One firm estimates a new plant which would produce 2 million tons of steel a year would cost $650 million. It states that the plant could not possibly be built and paid for out of profits at present prices.

The seeming paradox of record earnings and the steel industry's position that they are still too low has a twofold explanation. The older steel plants are getting to the point that they cannot be expanded further. New capacity must be built from the ground up in the near future.

Sufficient expansion funds are not available because plants are depreciated on the basis of original cost. Steel companies want the federal Government to permit them to use replacement cost instead for figuring depreciation. However, they have made little headway in this battle.

New Ethyl Petrochem Plant

BATON ROUGE.—Ethyl Corp. is moving further into the petrochemical business with announced plans for a vinyl chloride monomer plant to be built here. Produced from ethylene available locally, the plant will supply the plastics industry with an intermediate for making polyvinyl chloride, used in floor coverings, upholstery, electric wire, cables, and many other products.

Costing "several million dollars," the plant will add substantially to current vinyl chloride monomer capacity, Ethyl said. Initial production, due late next year, will be sold under long-term contracts.

June Imports Will Set Record

Firms reporting to commission estimate June imports will be 998,500 bbl. daily; drop slated in third quarter

CRUDE imports will set a new all-time record in June, according to company plans reported to the Texas Railroad Commission this month.

These companies brought in crude at an average rate of 761,200 bbl. daily during the month of April. However, this rate represented a planned reduction for the month to balance refinery runs that always reach the low point of the year in April. Crude imports dropped more than domestic production in April.

The latest reports to the commission show increases for May and June with an average of 998,500 bbl. daily in June. This total does not include any crude for Shell Oil Co.'s strikebound Anacortes refinery. Peak imports for this refinery was 44,000 bbl. daily.

What the Companies Told the Railroad Commission

(Thousands of barrels daily)

	Actual*		Estimated or forecast				
	April 1955	April 1956	May 1956	June 1956	July 1956	Aug. 1956	Sept. 1956
CRUDE—EAST COAST:							
Atlantic Refining Co.	64.7	56.7	70.6	70.6	70.6	70.6	70.6
Cities Service Co.	12.0	20.1	36.4	25.3	32.0	36.0	32.8
Eastern States Petroleum Co.	4.0	7.3	32.0	22.5	22.5	22.5	22.5
Gabriel Oil Co.		6.5	8.4	6.7	6.5	6.5	6.7
Gulf Oil Corp.	117.0	101.0	136.0	178.0	145.0	140.0	140.0
Lake Superior Refining Co.		5.3	5.3	5.3	5.3	5.3	5.3
Phillips Petroleum Co.	6.5	6.5	11.6	12.0	11.6	11.6	12.0
San Jacinto Petroleum Corp.		1.6	1.5	1.5	1.5	1.5	1.5
Sinclair Oil Corp.	60.4	68.4	73.2	79.9	77.2	74.2	74.2
Shell Oil Co.		0.5	1.0	1.0	1.0	1.0	1.0
Socony Mobil Oil Co., Inc.	85.4	64.4	74.5	66.5	66.5	66.5	69.5
Sohio Petroleum Co.		1.6	1.9	2.0	1.9	1.9	2.0
Southwestern Oil & Ref. Co.	7.5	3.6	3.5	3.7	3.6	(¶)	(¶)
Standard Oil Co. of Calif.	80.6	91.9	80.7	80.7	80.7	80.7	80.7
Standard Oil Co. (Ind.)	18.1	16.8	13.2	20.6	20.1	20.4	20.8
Standard Oil Co. (N. J.)†	60.0	72.0	79.0	79.0	83.0	83.0	83.0
Sun Oil Co.	7.6	34.4	26.1	58.5	61.3	57.3	57.5
The Texas Co.	58.3	52.4	63.3	84.6	79.2	79.2	64.0
Tidewater Oil Co.	7.6	15.1	14.4	25.8	26.2	24.4	21.8
Total East Coast	589.7	626.1	732.6	824.2	795.7	786.1	769.4
CRUDE—WEST COAST:							
Shell Oil Co.		4.0					
Signal Oil & Gas Co.		1.6	1.7	1.5	1.5	1.7	1.5
Socony Mobil Oil Co., Inc.	25.9	27.6	31.5	48.0	39.5	39.5	39.5
Standard Oil Co. of Calif.	19.7	19.5	25.0	25.0	25.0	25.0	25.0
The Texas Co.		30.7	58.1	18.0	29.7	24.6	29.0
Tidewater Oil Co.	34.1	32.3	49.5	65.3	51.1	53.6	57.2
Union Oil Co. of Calif.		14.1	10.0	10.0	10.0	10.0	10.0
Wilshire Oil Co.		5.3	23.7	6.5	21.8	16.6	16.6
Total West Coast	79.7	135.1	199.5	174.3	178.5	171.0	178.8
Total crude	669.4	761.2	932.1	998.5	974.2	957.1	948.2
PRODUCTS:							
Asiatic Petroleum Corp.	4.4	3.8	4.9	4.5	7.5	7.8	7.1
Eastern States Pet. Co.	23.5	10.2	10.0	10.0	10.0	10.0	10.0
Gabriel Oil Co.		0.9	1.1	1.2	1.1	1.1	1.2
Gulf Oil Corp.	5.0	7.0	3.0	7.0	7.0	7.0	7.0
Shell Caribbean Pet. Co.‡	110.0	143.0	105.0	114.0	85.0	75.0	70.0
Shell Oil Co.	17.9	20.1	28.5	23.1	22.4	23.4	23.1
Socony Mobil Oil Co., Inc.	13.8	4.2	11.1	11.1	11.1	11.1	11.1
Standard Oil Co. of Calif.			3.8	3.8	3.8	3.8	3.8
Standard Oil Co. (Ind.)§	15.3	27.4	21.8	22.4	20.8	20.9	26.0
Standard Oil Co. (N. J.)†**	167.0	116.0	122.0	122.0	115.0	115.0	115.0
The Texas Co.				4.2		4.0	4.0
Total products	356.9	332.6	311.2	323.3	283.7	279.1	278.3
Total crude and products	1,026.3	1,093.8	1,243.3	1,321.8	1,257.9	1,236.2	1,226.5
Bonded fuel included‖	67.5	36.3	50.8	46.6	49.4	50.6	49.2

*From company reports to the Texas Railroad Commission. †Based on quarterly estimates. ‡Imported by independent distributors. §Received through suppliers who can furnish either domestic or foreign oil. ¶Unreported by company but an average of 3,500 bbl. daily included in totals. ‖Mostly duty free for bunkering ships in foreign trade. **Includes bonded drawback for foreign flag international bunkers as follows: April, 37,000 bbl. daily; second quarter, 44,000 bbl. daily; third quarter, 47,000 bbl. daily.

Texas Cuts Allowable

Majority of buyers think production still too high, say they're being forced to store oil; imports get the blame

AUSTIN. — Texas crude-oil buyers won't be troubled with quite so much Texas crude oil next month due to a cutback in allowables for June.

But most buyers feel Texas allowables are still far too high for comfort.

The Texas Railroad Commission, huddling longer than usual following buyer testimony, settled upon a 15-day producing schedule for June. This cuts the initial June allowable 60,389 bbl. daily from that on May 5 and 27,884 bbl. from the initial figure for May.

Five major buyers feel the June schedule will meet their needs closely. But the remaining seven think the cut isn't nearly big enough.

Three of these favored 14 days and two recommended 13. Cities Service Oil Co., still plagued with a strike at its big East Chicago, Ind., refinery, said 10 days would meet its needs. And Shell wanted only 12 days' production.

Stanolind, which asked for 13 days, said it had stored several million barrels since the first of the year and was faced with having to store more. Gulf said it had stored 60,000 bbl. a day in April and 85,000 bbl. a day in May. A company spokesman said Gulf had leased all the tanks it could find. He added that the company would still be storing 50,000 bbl. a day in June if its 14-day proposal were adopted.

Imports draw fire . . . Commissioner Olin Culberson took a dim view of any large allowable cut. A slash to 13 days (a 351,035 bbl. daily cut from May 5), he said, would be disastrous. It could succeed only in sacrificing more market to imports.

Culberson pointed to imports for the 4 weeks ended May 13 of 928,600 bbl. daily, as compared to 704,300 bbl. daily for the same period last year.

Stocks evidence, he said, doesn't justify a large cut.

"Crude inventories are now 273,000,000 bbl., the lowest in 4 years. Days' supply on hand are now 30, the lowest in 6 years. And product supplies are 45 days, the lowest in 6 years. If we are going to cut and cut and cut, we are going to see imports supply the demand."

Strike troubles . . . Cities Service informed the commission that it was still taking only 80 per cent of normal volume from fields where it buys oil due to the East Chicago strike.

It hopes there will be some improvement by June but has no assurance that there will be.

The commission agreed to continue the hearing until the last 2 days of May to see if the Cities Service situation might change. If it does not, those fields cut back earlier in the month to assure ratable take will continue to produce at a reduced rate in June. These are fields in which Cities Service is one of several buyers and in which the other buyers were able to take the full allowable.

They include: Round Top, South Leuders (King sand), Elkhorn, Block 12, Shafter Lake, Vealmoor, Foster, and Wilshire (Ellenburger) fields — all in West Texas.

Trouble continues to crop up in the Scurry area where thousands of barrels of sour oil have been without a market for several months. Texas Consolidated Oil Co. asked for a top 10-bbl.-daily allowable per well in Sharon Ridge 1,700-ft. and 2,400-ft. and Coleman Ranch fields until more pipeline facilities are available.

The company, according to Ken English, has been informed by Coffield & Guthrie, the oil gatherer, that only 50 per cent of its production could be taken starting with the May runs. Waste and premature abandonment will result if this condition continues, he said.

JUNE CRUDE-OIL ALLOWABLE

District—	June	Change from May 5
1—Southwest	73,498	— 557
2—Gulf Coast	152,336	— 3,961
3—Gulf Coast	473,003	— 7,477
4—Southwest	249,703	— 5,002
5—East Central	47,694	— 759
6—Outside E. Texas field	129,205	— 2,332
6—E. Texas field	206,499	— 5,885
7-B—N. Central Texas	184,873	— 1,716
7-C—W. Central Texas	216,474	— 3,868
8—West Texas	1,094,443	—28,669
9—North Texas	306,195	— 1,734
10—Panhandle	127,328	+ 1,571
Total	3,261,251	—60,389

Gas Discovery Made in Louisiana Lake

NEW ORLEANS.—Shell Oil Co. has discovered a gas field in the southwest end of Lake Pontchartrain on a lease acquired from Louisiana last January.

The wildcat was drilled 6,000 ft. from shore in water 12 ft. deep. It is in Block 41, about 4 miles northwest of New Orleans' Moisant International Airport. On a drill-stem test the discovery flowed gas at the daily rate of 1,600,000 cu. ft. from 8,808-24 ft. (for details see page 195).

Shell bid $2,310,400 bonus for a lease on the 4,820-acre submerged tract January 18. This was the highest offer received for any of the seven lake-bottom tracts leased at that time. The test, spudded March 3, was drilled by Continental Drilling Co.

Oil-Hunt Secrecy Ended

California companies lose battle to keep their offshore exploration information confidential from state agency

LOS ANGELES.—Oil companies in California have lost their battle to keep offshore core-drilling and seismic information confidential.

The State Lands Commission in a hearing here approved a new permit form for conducting geological surveys. It specifically gives the commission the right to inspect all logs, records, and other information on operations done under the permit. The permit will cover only tidelands parcels not under lease.

In voting the new exploratory permit form, the commission rejected a set of proposals made in behalf of the industry by the Western Oil and Gas Association.

The conflict . . . The W.O.G.A. had suggested that the companies be allowed to keep confidential information on:

. . . Geophysical exploration of tidelands.

. . . Core-drilling operations offshore up to a 1,000-ft. depth.

It also recommended that information, such as electric logs, driller's logs, etc., be furnished the commission only on operations below 1,000 ft.

But the commission adopted its staff recommendations which call for the operator to:

. . . Disclose all his geophysical results plus the information gained from core drilling below 500 ft.

. . . Limit his core drilling below 500 ft. to a depth required to establish the first stratigraphic bed below the ocean floor.

. . . Pay for a full-time state inspector when coring below 500 ft.

The commission's staff contended the information required in the new rules is needed to determine whether areas under survey lie on a known geologic structure of a producing oil or gas field.

Objections . . . The industry vigorously opposed the new permit rules which would require companies to disclose coring and seismic exploration results.

Objections to these features were based on claims that such information, gathered at considerable expense, should be the confidential property of the operators.

Under the new leasing law in California, the commission has to establish whether a parcel under consideration for bonus bidding is part of a known producing structure. This information is necessary to establish the royalty provisions of the leases. If a parcel is classified as being an unknown area, then the royalty rate is 12½ per cent. If it is part of a known producing structure, then the royalty rate scales upward from a minimum of 16⅔ per cent.

Expanding core fleet . . . Reflecting the heightened interest in offshore exploration, two new core barges and a portable drilling platform will be added to the West Coast fleet in the next few months.

The Continental-Union-Shell-Superior (C.U.S.S.) group will be operating a barge being built by Stone & Webster and Macco Corp. General Petroleum Corp. within a month hopes to complete work on a 176-ft. landing craft which is being converted for midship drilling.

First platform will be that of Monterey Oil Co., Humble Oil & Refining Co., and Seaboard Oil Corp. Capable of drilling in waters up to 90 ft., the platform will first be used for stratigraphic work on their 1,280-acre lease which begins 1 mile offshore from Huntington Beach. Delivery of the barge from the Gulf Coast is expected July 1. Under terms of the state lease, granted before the new law became effective, development drilling must be carried out from an earth-filled island.

At least five barges are now at work in California coastal waters. These include two for Richfield Oil Corp. and one by Standard Oil Co. of California, Western Gulf Oil Co. and the C.U.S.S. group.

Other action . . . Almost lost in the hassle over the new coring and seismic regulation was action by the commission giving the go-ahead for bonus bidding on a 500-acre parcel off Summerland, Santa Barbara County.

This is the first parcel to be put up for bidding under the new law. The industry and the state unanimously agreed to the terms of a lease which cleared the decks for this action.

The state will advertise for bids around June 1. The commission, with the industry's concurrence, shortened the normal 60-day bidding period to 30 days on this parcel. St. Anthony Oil Co. originally asked that the parcel be put up for bids.

The commission also agreed to investigate requests for bonus bidding on two other parcels. One involves 16,700 acres offshore from the Ventura-Los Angeles County lines and the other 5,500 acres offsetting the 500-acre Summerland lease.

The commission and the industry also agreed on a set of operating procedures and rules for developing offshore producing properties. The rules and regulations are concerned with site beautification, protection of recreational and residential properties, and removal of equipment from abandoned tideland leases.

Pipeline in the ground, but . . .

. . . Battle Rages Over Permit

MINOT, N. D. — Montana-Dakota Utilities Co. is still battling for a permit to build a line it has completed and been operating 4 months. Rates to be charged also are at stake in legal tussels with the North Dakota Public Service Commission.

The fight is over an 80-mile, 12-in. natural gas line Montana-Dakota built from Tioga to Minot. It was finally put into service last January by a district order *(The Oil and Gas Journal, January 16, page 71)*. Service is now going to 2,400 customers in Minot. Work is proceeding this spring on distribution systems to other towns along the line.

But spring also has brought more sparring between Montana-Dakota and the commission. These are the latest developments:

. . . A May 28 hearing at Bismarck has been set by the Public Service Commission on its complaint that Montana-Dakota ordered start of the line without first getting a state permit.

Montana Dakota claims it did not need a certificate, since none is required when a utility extends its service into nearby territory. The utility says the line actually is an extension of its system from Williston.

. . . A June 21 hearing at Minot also has been called by the commission to reopen the utility's original application.

Officials say purpose of this is to lower the price at which Amerada Petrolem Corp. and Signal Oil & Gas Co. sell gas at Tioga to Montana-Dakota. The commission claims the tax value is only 4½ cents per M.c.f.

while the utility is charged 16 cents. The state wants to make testimony from Amerada and Signal a part of the record. Signal operates the Tioga plant which processes gas for Amerada and other producers.

After the hearings, the commission is expected to issue another set of conditional orders which the utility must fulfill to receive certification. The utility objected to the first orders.

Meanwhile, a Federal Power Commission examiner has recommended a permanent certificate for Montana-Dakota's Tioga-to-Williston line.

The FPC examiner also upheld the prices charged the utility by Amerada and Signal. Amerada sells "dump" gas for 9 cents per M.c.f. Signal sells residue gas on a firm contract at 16 cents. The state commission had attacked both prices as unreasonable.

Study Funds Slashed

Senate group waters down investigation of Compact

WASHINGTON. — Justice Department plans to make a big production of investigating the Interstate Oil Compact were punctured last week by skeptical senators.

The Senate appropriations committee tossed out the $763,000 fund granted last month by the House. It told the Senate $25,000 should be enough for the survey and report ordered by Congress last year.

The committee's award is subject to action by the Senate and then to acceptance or compromise in conference with the House. But it appears unlikely that the department will get the big deal laid out by Atty. Gen. Herbert Brownell.

It is no secret that the department didn't want the job of policing the Compact. For years it had reported to the House interstate commerce committee that it was watching Compact operations and found no indications that they violated the antitrust laws.

The plan laid before Congress called for the opening of three new field offices and the employment of 147 persons, 34 of whom would be atttorneys. The field force would number 110.

"An explanation of the legislative history of the amendment to the Interstate Compact to conserve oil and gas which authorized the survey and report gives no indication that such an elaborate expansion of antitrust personnel was ever contemplated by Congress," the appropriations committee reported. "The commission itself expends only $90,000 annually in its work."

watching WASHINGTON

. . . with Bertram F. Linz

Oil industry hit by senator's death . . .

DEATH of Sen. Alben W. Barkley of Kentucky has put a man unfriendly to the oil industry on the powerful Senate finance committee and taken a man friendly to the industry off the Interior committee.

Senator Paul H. Douglas of Illinois, who has long favored reduction of the 27½ per cent depletion allowance, has been assigned to the highly conservative finance committee. Practically every Democrat on that committee, and most of the Republicans, are opposed to a reduction.

Sen. Russell B. Long of Louisiana, a liberal, who was third ranking member of the Interior committee, has stepped down to take Barkley's chair in the foreign relations committee.

At least one more change in the finance committee is in sight for next January. Another liberal, Sen. John O. Pastore of Rhode Island, is in line to succeed Sen. Walter F. George of Georgia. George will resign at the end of the session to become President Eisenhower's representative to NATO.

If more than one spot on the committee is opened up, still another liberal, Sen. Albert Gore of Tennessee, is in line.

The finance committee deals with all matters of taxation and appropriations. It has been a real "watchdog" of the Treasury Department, cutting down the big ideas of both Democratic and Republican administrations. It is so conservative that even if the liberals named get seats on it they will make no great impression on its policies.

U. S. gets more gasoline taxes . . .

TAXABLE gasoline consumption during the 9 months ended with March was 30,000,000 bbl. above the same period the year before.

As a result, the Treasury collected an additional $63,000,000 to bring the total for the first three quarters of the Government's fiscal year to $795,206,000.

Officials look to a total of more than $1,000,000,000 from this source for the year ending June 30. In addition, there will be $140,000,000 or more from the three other oil taxes—lubricating oil, pipeline transportation, and diesel fuel.

The Treasury figured last January it would collect $1,104,000,000 from the four taxes, based on repeal of the emergency ½-cent increase on motor fuel April 1. But the increase was not wiped out, so the Government stands to get an additional $70,000,000 or more during the current quarter. Actual collections through March were $896,000,000. Another $350,000,000 may be collected in the final 3 months.

Congress urged to shift gasoline tax . . .

CONGRESS is being urged to shift the gasoline tax from refiners to jobbers.

The change, which would lighten the burden on the jobber, although on its face it looks as if it would be the other way around, is supported by both groups.

Jobbers now have to pay the tax when they buy fuel from the refiner. In the case of a large operator, this ties up a lot of money which can be recovered only gradually as gasoline is sold. And the jobber takes a loss on evaporation and spillage.

So far, the retailers haven't said anything about having the tax further transferred to them. In a smaller way, they have the same disadvantages. But leading jobbers have said if the retailers want such a transfer, they will go along with it.

Gas Lobby Probed Again

Special bipartisan Senate group opens sweeping inquiry into political activities behind Harris-Fulbright bill

WASHINGTON.—A searching probe of lobbying for and against the Harris-Fulbright gas bill is getting into full swing

Natural gas will be the first subject on the lengthy agenda of a special committee set up by the Senate to investigate political activities, lobbying, and campaign contributions.

The inquiry will start with four interest groups, two for and two against the Harris-Fulbright bill. But it also will follow up on the Case "incident" which triggered the investigation.

Disclosure by Sen. Francis Case of South Dakota that he had been offered a $2,500 "oil contribution," apparently conditioned on his support of the bill, led to its veto by President Eisenhower. A special committee headed by Sen. Walter F. George of Georgia made an investigation last February, but without conclusive results.

About the "incident" . . . Howard Keck, president of Superior Oil Co., will be questioned in Los Angeles this week on circumstances of the $2,500 "contribution" offer to Senator Case. The offer was made by a Superior attorney.

The special committee is a bipartisan group of four Democrats and four Republicans. Sen. John L. McClellan of Arkansas is chairman. The other Democratic members are Sens. Albert Gore of Tennessee, Clinton P. Anderson of New Mexico, and John F. Kennedy of Massachusetts. Sens. Styles Bridges of New Hampshire, Edward J. Thye of Minnesota, William A. Purtell of Connecticut, and Barry Goldwater of Arizona are the Republican members.

The four groups which have been found to have actively lobbied for or against the gas bill included two "public" groups and two industry groups. The first two had no specific economic interest in the bill. They were supporting opposing views on government control and natural resources.

The other two groups had a dollar interest in the measure. One was composed of gas producers and pipeline operators opposed to price control and arguing for a free, competitive market for their production and service. The other included certain big-city mayors, some organized consumer groups, and a number of gas-distributors who favored federal price regulation.

A stern word of warning to the committee against letting its inquiry degenerate into a political circus was

ARKANSAS' McCLELLAN
. . . heads probe of gas-bill lobbying

voiced last week by Sen. Andrew F. Schoeppel of Kansas.

The industry's efforts for and against the bill "were natural and justifiable attempts to improve or protect their economic positions," Schoeppel said. "And to deny them that privilege would be to deny them the protection of the first amendment of our Constitution."

As to the Case matter, Schoeppel said, had it been "dreamed up" by those opposing the bill "it would have been a sheer stroke of genius." The efforts to influence Case and others "suggest a brand new approach to the defect of legislation," he commented.

Schoeppel pointed out the ease with which a whole industry or group can be tarred by charges of corruption based on isolated incidents.

"Judged only by occasional miscarriages of justice, our jury system needs a complete overhauling," he said.

"Judged only by the incidence of racketeering, labor union regulations require a complete overhauling.

"Judged only by Teapot Domes and attempted $2,500 bribes, the lobbying relations of the oil industry require complete overhauling.

"But as a matter of fact, none of these statements are true."

All four of the groups involved in the natural-gas bill "were simply doing what came naturally," Schoeppel stressed. In an overwhelming majority of cases, their behavior was completely proper.

But the senator warned that this being an election year there will be a great temptation on the part of a few committee witnesses to attack and counterattack with an eye to headlines.

Big names, half truths . . . "Big names may be bandied about," Schoeppel warned. "Half truths may get into the record. And what would be much worse, half truths may get into the public press.

"The results would damage everyone concerned, because the public is in no position to accurately discriminate, in a rough and tumble political argument, between the alleged sheep and the alleged goats."

With Congress planning to adjourn by July 15, the committee will have only 6 or 7 weeks for its investigation. This will not give it time for much more than an inquiry into the gas lobbies before it breaks off for the summer.

A number of other groups may be examined next year. These could include groups interested in agricultural legislation, transportation, and many other matters. It also has been suggested that the political activities of the labor unions should be studied. Reportedly, they have a multimillion dollar "war chest" for the election of the "right" candidates for state and federal offices.

Since the committee was appointed February 23, its staff has been preparing the groundwork for the hearings. So far its only open action was a hearing at which Maston Nixon, chairman of the general gas committee, appeared early this month *(The Oil and Gas Journal, May 7, page 99)*. The hearing was called at Nixon's request before leaving for a trip abroad.

House to Study Coal Uses

WASHINGTON.—An intensive study of possible new uses for coal will get under way next week by the House interior committee.

Synthetic liquid fuels, gasification, and chemicals will be major subjects at hearings which will begin June 4 and run through the rest of the congressional session.

Sen. Everett M. Dirksen of Illinois has asked the Senate to make a similar study through its own interior committee.

Purpose of the studies is to map out a broad research program to be sponsored by the federal Government.

The House committee listed 14 subjects for study. Eight relate to present coal operations. The rest are new fields which might be developed. These include hydrogenation, carbonization, gasification, oils and tars, and coal chemicals.

Key Gas Ruling Appealed

Panhandle Eastern asks Supreme Court to recognize fair field prices, gasoline extraction as separate operation

WASHINGTON. — A vital issue in natural-gas pricing reached the U. S. Supreme Court last week.

It's whether a pipeline is to be permitted a fair field price as an incentive to increase its own production. Panhandle Eastern Pipe Line Co. asked a review of a decision by the District of Columbia Federal Court of Appeals which limited the Federal Power Commission in allowing a fair field price.

The FPC has asked the Department of Justice also to seek a Supreme Court review.

Panhandle also sought a high court ruling on another important question: Is a separate business of extracting and selling natural gasoline from natural gas to be controlled by the FPC?

The fair field issue is of great importance in determining how the FPC is to go about finding just and reasonable prices for gas produced by independent producers. It reached the Supreme Court after a 2-year delay following an FPC decision in April 1954 granting Panhandle the fair field price for gas produced from its own wells.

The FPC tried to get away from the traditional method of basing rates on the cost of facilities used. It ascribed a commodity value or field price to the gas. The decision was appealed by the city of Detroit and Wayne County, Michigan. The appeal challenged the ruling, which in effect gave Panhandle's own production virtually the same treatment as gas it purchased from others.

Commodity-price issue . . . The Circuit Court did not question the FPC's right to depart from the cost rate method, but it nevertheless reversed the commission.

It said that while FPC need not follow the cost method strictly, it must use it as a starting point. The FPC must justify any new method by proving that the resulting price is just and reasonable and is not more than sufficient to provide an incentive to produce gas *(The Oil and Gas Journal, December 26, 1955, page 125, and May 21, 1956, page 217).*

The holding of the Circuit Court "necessarily makes a sacred cow out of the 'traditional' rate-base approach," the company asserted. It said the Supreme Court itself has held that Congress had not provided any formula by which a "just and reasonable" rate is to be determined. Rather, the company said, the "end result" is the test.

"The rate-base method as a superimposed test or measure of the commodity value approach results in something which is neither fish nor fowl," the appeal contended.

"There is no workable relation between the two methods. Whether the commission's direct method of pricing produced natural gas as a commodity can be used or whether, instead, the court below can dictate an illogical compromise is a question which should be decided by this court."

Gasoline extraction controls . . . The further issue of gasoline extraction, while shadowed by that of commodity value, is in its own right a matter of major concern to the natural-gas industry, the court was told.

In the past it was generally true that wet gas had to be treated by a pipeline before the dry gas was transported. For this reason, the FPC then charged all costs and credited all revenues from gasoline extraction to the cost of gas service. The theory was that gasoline extraction was not a separate business but an indispensable part of a pipeline's operations.

In its case, however, Panhandle showed it could discontinue the gasoline operation without interfering with its pipeline operation. The FPC held its extraction business should be treated as being apart from the gas business. Therefore the joint costs of gathering and moving the natural gas to the gasoline plant should be allocated accordingly. And profits from the sale of liquid products should not be a factor in fixing rates on the residue gas.

Prior to the Circuit Court decision it had never been held or even intimated that the FPC has direct jurisdiction over a pipeline's gasoline-extraction operations. But the court reversed the FPC, rejecting its contention that the rates it sets for natural gas should not depend upon the fluctuating and unregulated prices of gasoline.

"The decision of the court below, if followed literally, has wide implications," Panhandle said.

"It would seem that if the gasoline-extraction operation is jurisdictional, as the court stated without qualification, then logically the commission would fix the rates at which gasoline sales are made and in general subject the business to the manifold regulatory controls now reserved by statute only for the natural-gas business."

Petroleum rival looms in . . .

. . . New Shale Oil Pilot Plant

DENVER.—This country's first shale oil pilot plant using the new Swedish Aspeco process will be built and operated in Denver.

Award of a $100,000 contract to Stearns Roger Manufacturing Co., Denver, for construction of the 24-ton-a-day plant has been announced by the Research Institute of the University of Denver. Last January, a $250,000 contract was signed between the institute and Oil Shale Corp. of Beverly Hills, Calif., for development of the new Swedish extraction process.

The pilot plant will be located on a 2-acre tract in extreme south Denver.

The institute has been operating a 300-lb.-an-hour prepilot plant at the university.

"With the 300-lb. model we have been working out problems that need to be solved before final designs of the ton-an-hour pilot plant can be drawn," said Dr. Charles H. Prien, head of the institute's chemical division.

"Actual construction of the plant will not begin until such designs are completed, but we hope to see the larger plant in operation late this fall, possibly in October."

Aim of research . . . Purpose of the research and development project is to reduce the cost of processing oil from shale to a point where it can become competitive with petroleum from wells. Backers of the undertaking believe it is possible to cut the refinery cost of gasoline from shale oil to 13 cents from 16 cents.

Oil Shale Corp. holds United States rights to the Aspeco process. The original Swedish rights are owned by Aspengren & Co. of Stockholm.

The process employs a novel method of carrying heat to the crushed oil shale without exposing it to combustion. Steel balls are preheated to 1,000° F. and fed into a revolving ball mill where they meet the raw shale.

The shale oil passes off as vapor and the spent shale, still containing cokelike carbon, goes to a combustion chamber where the carbon is burned with air and used to reheat the steel balls.

LOUISIANA OIL PRODUCERS turned out en masse to help the Louisiana Department of Conservation devise a new production allowable formula. They'll be asked to submit drilling-cost data to . . .

Commissioner John B. Hussey (right), and Thomas M. Winfiele, chief engineer of the Conservation Department.

Louisiana Seeks New Allowable Formula

BATON ROUGE. — The Louisiana Department of Conservation, assisted by a large industry advisory committee, has tackled the thorny problem of revising the state's formula for setting crude-production allowables.

The study follows the second consecutive cut in Louisiana's production allowable. This step was forced by the state's continuing oil boom coupled with lower seasonal demand.

Aim of the study, according to Conservation Commissioner John B. Hussey, is to find a fairer method for allocating production among the state's pools and individual wells. He indicated the new formula probably will reflect reserves and acreage. It also will include differentials for producing depths as used now.

Hussey's plea for advice got a ready response. Nearly 100 spokesmen for Louisiana producers and royalty owners crowded a conference room in Hotel Heideberg in Baton Rouge May 17 to help mold a new allowable pattern.

What formula to use . . . Strong sentiment was expressed in favor of a formula based partly on reserves.

Also drawing support from several operators was a proposal by Magnolia Petroleum Co. tending to give deep wells a higher percentage of the total production allowable.

E. P. Keeler, representing Magnolia, presented an allowable formula based on well costs. His proposal would set a basic production allowable of 1 bbl. daily per $1,000 expenditure in drilling and completing a well. This basic allowable would be trimmed 25 per cent to balance production with demand.

Figures compiled from cost data on a limited number of wells indicated costs in Louisiana ranged from about $10,000 for a test less than 2,000 ft. deep to $672,000 for a well in the 16,000-17,000-ft. bracket. Comparable figures for a well offshore would range from $98,000 to $1,410,000, according to Magnolia's survey.

The proposed schedule, based on Magnolia's study, would increase al-

ATLANTIC'S GARRETT
. . . Well depth and acreage

HUMBLE'S BOLDRICK
. . . Reserves, depth and demand

MAGNOLIA'S KEELER
. . . More for deep wells

lowables for onshore wells drilled below 10,000 ft. Production from wells of lesser depth generally would be cut. Production would be increased from offshore wells drilled below 3,000 ft.

Under the Magnolia proposal as calculated from limited cost figures available, the allowable of an onshore well drilled to 2,000 ft. would be cut from the present 34 bbl. daily to 8 bbl.

The reduction would range about 76 per cent for a 2,000-ft. well to a mere 2 bbl. per day (or about 1.7 per cent) for a 10,000-ft. well. For wells below 10,000 ft. the allowable would be gradually increased. Thus, the allowable of an 11,000-ft. well would be increased from the present 130 bbl. to 141 bbl. daily. Allowable for a 17,000-ft. well would jump all the way from the present 282 bbl. daily to 504 bbl.

In the offshore area, the allowable of a 2,000-ft. well would be reduced from 111 bbl. daily at present to 74 bbl. daily. A 3,000-ft. well would be allowed to produce only 107 bbl. daily instead of the present 120. But below 3,000 ft. the allowable would go above present levels. A 4,000-ft. well, for instance, could produce 133 bbl. daily under the proposed plan as compared to 128 bbl. daily under the present depth-bracket system. The increase would become greater in lower depth brackets.

Costs collected . . . In accordance with the suggestion by Magnolia and several other operators favoring the plan, Hussey said companies operating in Louisiana will be asked to furnish basic well-cost data. It will be used in overhauling the production allowable.

He said information obtained through questionnaires will be confidential and companies will not be identified with their cost data.

Hussey indicated the Magnolia plan may be worked into the new formula. But he declared he favors an allowable based on several other factors including reserves and surface location in addition to well depths or costs.

Humble's plan . . . A three-phase plan including such factors was proposed by John Boldrick, Humble Oil & Refining Co.

He outlined a possible formula whereby the allowable for a given pool would equal the remaining recoverable reserves multiplied by a depth factor and by a market-demand factor.

Under the Humble plan, total production from each pool then would be divided among the various wells in that pool according to acreage involved. The plan also would provide a differential between onshore and offshore wells.

Boldrick suggested the conservation department could assign a reserve figure to newly discovered pools. This figure would be used in setting allowables until five wells had been drilled in a new pool.

Emphasis on acreage . . . Atlantic Refining Co. also proposed a formula taking into account both well depth and surface acreage.

"As far as the acreage phase of the proration formula is concerned," said Atlantic's John Garrett, "what we are really trying to do is to get some measure of reserves into the formula. We see no practical method of inserting recoverable oil as such into the allocation formula. However, acreage is a primary factor in reserves. It can more readily be incorporated."

Garrett suggested that curves be drawn showing costs of a well in terms of depth for each of the major producing areas—North Louisiana, South Louisiana, and offshore.

He also suggested a production cut for wells not capable of producing their allowable.

"The proration of this type of wells must be done sooner or later," he said, "or else the time will come when top allowables are so small further exploration will be hard to justify."

Offshore trouble . . . Conflicting views were expressed regarding offshore allowables.

W. G. Lastrapes, of The Texas Co., introduced a statement favoring a reduced differential between onshore and offshore wells.

However, continuation of bonus allowables for offshore oil wells was urged by spokesmen for Phillips Petroleum Co., Shell Oil Co., and The California Co., all leading producers in the Gulf of Mexico.

Lesser allowable for dual and triple completions were suggested by Ralph L. Hock, speaking for A. J. Hodges Industries, Inc. A similar suggestion was made by spokesmen for several major producers.

Hussey said after the meeting that the present depth-bracket formula will be maintained in setting allowables until a new system is drawn up.

No cure-all . . . The commissioner warned that adopting a new allowable formula will not solve Louisiana's production problems.

The state's production capacity is rising at 12,000 to 15,000 bbl. per day each month, he said. Demand for crude is rising about 5 per cent a year, or 3,000 bbl. daily each month in Louisiana.

He said the situation in Louisiana will be "a living problem for years to come, or for many months to come at least."

Refining BRIEFS

DAWSON CREEK, B. C. — Excelsior Refineries, Ltd., has placed its new $2,000,000 refinery on stream here. The plant is rated at 2,000 bbl. per day on crude capacity and includes a 500-bbl. per day Houdriforming unit for making high-octane gasoline. It is located in northeast British Columbia near Peace River.

WICHITA FALLS, Tex.—Panhandle Oil Corp. will double the high-octane gasoline capacity to 6,500,000 gal. a month at its refinery here. Construction will start in about a month on a new Platformer. The unit will also enable the refinery to boost crude throughput from 7,000 bbl. to 8,000 bbl. Estimated cost is $750,000. Improvements to existing processing units are planned later.

EDMONTON, Canada.—McColl-Frontenac Oil Co., Ltd., has awarded a design and construction contract for a 3,300-bbl. Platformer at its 13,000-bbl. refinery here. The contract went to Refinery Engineering, Ltd., of Toronto and Tulsa.

ARTESIA, N. M. — A 1,500-bbl. Houdriformer is expected to go on stream about June 1 at Continental Oil Co.'s 4,300-bbl. refinery here. Refinery Engineering Co. of Tulsa designed and is building the unit, which is licensed by Houdry Process Corp. It will process straightrun naphthas to produce high-octane gasoline blending stock.

KEVIN, Mont. — Montana's first Platforming unit has gone on stream here at the refinery of Big West Oil Co. of Montana. The 1,000-bbl. unit was designed, engineered, and licensed by Universal Oil Products Co. Procon, Inc., was the contractor.

NEWCASTLE, Wyo.—Sioux Oil Co. has completed a $400,000 Houdriforming unit at its refinery here. The unit was designed by Litwin Engineering Co., Wichita, and licensed by Houdry Process Corp. An L.P.G. recovery unit to manufacture propane and butane will be next. It's all part of Sioux's modernization program to increase refining capacity and efficiency.

EL DORADO, Kans. — El Dorado Refining Co. will complete work in mid-July on a 2,500-bbl. Platformer at its 16,000-bbl. refinery here, but the unit won't go on stream before September. The company is doing its own construction work under supervision of H. J. Datin, refinery superintendent.

Hot MER Issue Avoided

Question of two MER's in one pool sidetracked by Gulf's new plan to hike allowable of Goldsmith San Andres unit

AUSTIN.—The Texas Railroad Commission may not have to decide after all whether there can and should be two maximum efficient rates of production (MER's) in one reservoir.

It appeared until last week that the commission would have to settle this ticklish issue in the huge Goldsmith San Andres field of Ector County, West Texas.

The issue arose when Gulf Oil Corp., operator of the Goldsmith San Andres unit in the south dome area of the field, asked that the unit MER be hiked from 16,250 bbl. to 27,000 bbl. per schedule day. It asked at the same time that the MER in the north, nonunitized end of the field be continued at 10,000 bbl. daily *(The Oil and Gas Journal, April 9, page 76).*

Background . . . Gulf, in arguing for a higher MER, pointed out that a big water and gas-injection project launched by the unit in October 1954 had built up bottom-hole pressure substantially.

Large sums of money were spent on the program. But the unit still is allowed only the same amount of oil production per well as before unitization. This is 34 bbl. per producing day, while the 1947 yardstick allowable for the depth is 73 bbl. per day. The upshot, Gulf said, was that:

. . . Other such worthwhile projects would be discouraged.

. . . Oil was being drained from the unit by wells in the north end where pressure is lower and still dropping.

But operators in the north end said the commission had no authority to set up two MER's for one reservoir. Such action, they said, would bring on overwhelming administrative problems and inequities in many other fields.

The commission accepted these arguments. But Gulf won a rehearing.

Unit changes tack . . . This time the unit proposed an allowable bonus plan which was more palatable to operators outside the unit.

It provides for allowable credit for fluid injected into the San Andres over and above the production volume. It resembles, in its effect, that recently proposed by the SACROC unit for Kelly-Snyder field which is still under study by the commission.

The maximum unit allowable permitted under the bonus-for-injection formula would be roughly 38,690 bbl. per producing day. This is calculated by multiplying the number of producing wells (530) by the yardstick depth allowable (73 bbl. per well).

Gulf said that under the rule and at present injection rates the allowable would be about 48 bbl. per well, or 25 bbl. below the yardstick allowable. The unit total would be roughly 25,440 bbl.

Under the proposed formula the allowable credit would be equal to net water input over GOR times gas-volume factor plus gas input over GOR minus basic allowable.

As a second choice Gulf renewed its proposal for raising the unit MER to 27,000 bbl. per day, a move opposed by Stanolind Oil & Gas Co. and Shell Oil Co., operators in the north end of Goldsmith. Both favored the bonus-for-injection rule.

Canadian Imports Level Off

• U. S. refiners take 117,526 bbl. daily from Alberta and Saskatchewan during the first quarter of the year

CANADIAN crude imports registered another over-all gain during the first quarter of 1956. But the upward trend which started a year and a half ago is showing signs of levelling off.

The increase continued through February, but fell off slightly in March. And Alberta crude nominations for April were below the March figure by about 500 bbl. daily.

A daily average of 117,526 bbl. came into this country during the 3-month period. About 100,402 bbl. of this was from Alberta and 17,124 bbl. from Saskatchewan.

Here's the way the daily buying from both provinces went for the period: January, 113,194 bbl.; February, 121,400 bbl.; and March, 117,890 bbl.

Saskatchewan imports showed a steady decline from 21,834 bbl. daily in January to 13,561 bbl. daily in March.

Three new refineries, which helped extend the upward crude-buying trend into 1956, accounted for more than two-thirds of the total Canadian take.

Biggest single importer was Shell Oil Co., which brought in a daily average of 40,000 bbl. for its Anacortes, Wash., refinery, despite the fact that the big new plant has been crippled by a strike. The Anacortes refinery took in 42,500 bbl. daily in March.

The two other new refineries are General Petroleum Corp.'s Ferndale, Wash., plant, which accounted for 26,500 bbl. daily, and the Pine Bend, Minn., refinery operated by Great Northern Oil Co., a new firm. The latter's daily take was about 18,847 bbl.

Great Northern was one of two U. S. companies drawing crude from Saskatchewan. It averaged more than 13,000 bbl. daily from this source.

The other firm relying on Saskatchewan crude was Northwestern Refining Co., which took some 3,800 bbl. daily from this area. Northwestern also took a daily average of 8,000 bbl. from Alberta.

Tidewater Oil Co. boosted the January imports by about 3,840 bbl. daily with a spot purchase of 119,000 bbl. of Alberta crude.

This was delivered to San Francisco by tanker. The rest of the Canadian crude was moved by pipeline.

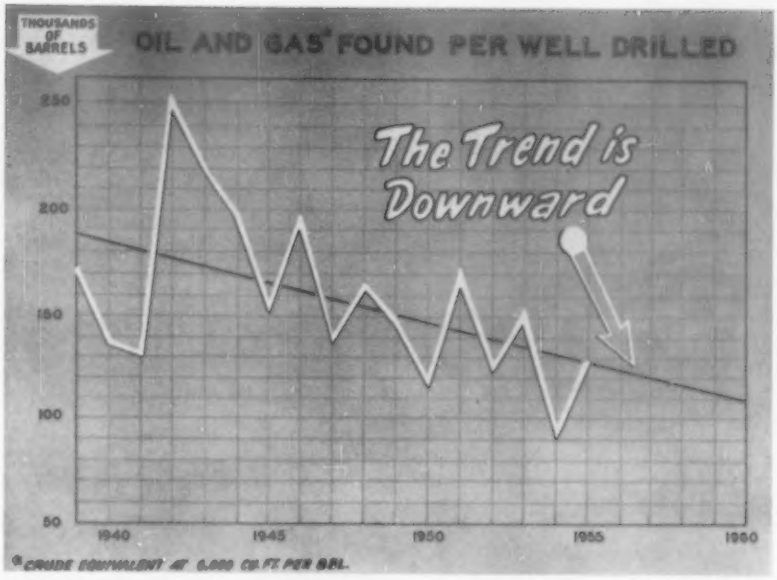
Where Canadian Crude Imports Are Going

ALBERTA
(Barrels daily)

Company, location—	Jan.	Feb.	Mar.	Total
General Petroleum Corp., Ferndale, Wash.	26,500	26,500	26,500	79,500
Great Northern Oil Co., Pine Bend, Mich.	6,500	8,000	8,000	22,500
International Refineries, Inc., Wrenshall, Minn.	9,680	10,345	11,290	31,315
Lake Superior Refining Co., Superior, Wis.	4,840	5,175	4,839	14,854
Northwestern Refining Co., St. Paul Park, Minn.	10,000	8,000	6,000	24,000
Shell Oil Co., Anacortes, Wash.	30,000	47,500	42,500	120,000
Leonard Oil Co., Alma, Mich.	.....	.....	3,000	3,000
Bay Refining Corp., Bay City, Mich.	.....	.....	2,200	2,200
Tidewater Oil Co.	3,840	.....	.....	.....
Total	91,360	105,520	104,329	297,369

SASKATCHEWAN
(Barrels daily)

Great Northern Oil Co., Pine Bend, Minn.	17,189	12,543	10,152	39,884
Northwestern Refining Co., St. Paul Park, Minn.	4,645	3,337	3,409	11,391
Total	21,834	15,880	13,561	51,275



We're Finding Less Oil Per Well

THE oil industry's skyrocketing costs have been given a lot of publicity in recent months. It's generally recognized that wells are going deeper—at greater expense—and that costs for labor and materials are still spiraling upward.

But there's a trend which is compounding these oil-finding costs: It takes more wells nowadays to find the same amount of oil.

Wells drilled in 1955 added an average of 127,000 bbl. to the nation's supply. This is a comeback from the 91,000-bbl. average per well in 1954, but it's still lower than all but three of the years since 1940.

The average amount of oil and gas found for each well drilled has fluctuated widely from year to year. But since the war the trend has been steadily downward. It means the returns for drilling risks are declining.

If this downward trend continues, current discoveries per well will drop below 99,000 bbl. after 1960. The 99,000-bbl. figure represents the cumulative average of all oil and gas found per well drilled since the Drake discovery.

What chart shows . . . Discovery totals used include all crude, natural gas, and natural-gas liquids produced each year, also net additions to reserves during the year.

The natural-gas production includes marketed production plus amounts flared or lost. All gas is included at the ratio of 6,000 cu. ft. of gas per barrel of crude.

Total wells drilled are from records of The Oil and Gas Journal. They include dry holes and productive wells in both wildcats and development drilling, plus service wells.

Ratios plotted on the chart result from the division of total oil and gas found by total wells drilled.

Unrealistic peak . . . The high returns per well drilled in the early war years were due to revision of reserves figures in previously discovered fields.

Oil discoveries and revisions in 1942, for example, dropped only 4.5 per cent from the 1941 total. Yet drilling was off 43.5 per cent. Estimates of natural-gas reserves by Petroleum Administration for War and natural-gas production during 1942 indicated greater gas discoveries for that year than for 1941.

Upward revisions for oil and gas reserves in a year when wartime scarcity of steel reduced drilling caused the unrealistic peak shown in the chart for 1942.

For the period since 1945, however, direction of the graph line has shifted every year except 1942. Despite these annual peaks and valleys, the trend has been downward.

Clareton Flood Studied

CHEYENNE, Wyo.—The Wyoming Oil and Gas Conservation Commission is considering a petition to water flood Clareton field.

Sioux Oil Co. of Newcastle, Wyo., proposes to inject water into a deep oil well in the Hay Creek area.

Last June, the commission ordered 167 of the 608 producing wells in the Clareton field shut in for producing gas in excess of 5,000 cu. ft. per barrel of oil. The order, extended twice, is effective until December 1.

Dent N. Hand, vice president of Sioux, said the proposed project still is in the preliminary stage. Purpose of the petition, he explained, is to get initial approval of the flood before additional time and money are invested in completing engineering work and obtaining the water supply.

Montana Pipeline?

Interstate studying outlet for new Wolf Springs field

BILLINGS, Mont. — Interstate Oil Pipe Line Co. is exploring the possibility of constructing a 55-mile, 8-in. crude pipeline from Billings to the recently discovered Wolf Springs field in northeastern Yellowstone County, Montana.

H. S. Foote, district superintendent for Interstate, said the project also would include a pumping station and gathering facilities in the field. He said a decision on whether to build the line will be made "in the near future." Estimated cost of the project was not announced.

There are now seven producing wells in the Wolf Springs field. Operators are Atlantic Refining Co., DeKalb Agricultural Association, and Carter Oil Co. Atlantic and Carter are now drilling two additional wells. Production from the field is being trucked to the Carter refinery in Billings.

The field was opened in June, 1955, by Atlantic's 1 Horton Estate discovery well. Production zones lie in the Amsden dolomite at the 6,100-ft. level. The area is geologically located on the east flank of the Bull Mountain syncline.

Severance Tax Opposed

CASPER, Wyo.—The Rocky Mountain Oil and Gas Association will oppose any form of severance tax in Wyoming.

Robert H. Martin, R.M.O.G.A. division manager here, said the oil industry in Wyoming already is heavily taxed. For one thing, he said, oil is assessed at 100 per cent of the posted field price, which is contrary to assessment practices elsewhere.

Agitation for a severance tax arose late last year after Continental Oil Co. announced plans to shut down its 4,500-bbl. refinery at Glenrock, Wyo. Newspaper editors at Glenrock, Douglas, and Wheatland—claiming Wyoming oil would be piped out of the state for refining—revived a campaign for a severance tax on the state's natural resources.

Work Resumed on Line

Westspur ends cold-enforced shutdown of construction on Saskatchewan system; completion set for summer or fall

REGINA.—Westspur Pipe Line Co. recently resumed construction of its new 174-mile crude-oil gathering system in southeastern Saskatchewan after a 5½-month shutdown enforced by extreme cold weather and frozen ground.

Westspur official A. M. McRae estimates the line will be completed and in operation by late summer or early fall. All needed pipe and other supplies were brought in during the winter shutdown and distributed at strategic points.

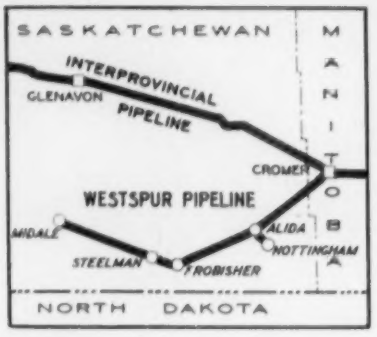
The Westspur project is being built at a cost of about $6,400,000 by 16 oil producers in the area. It will consist of 109 miles of 12-in. and 65 miles of smaller diameter lines. Initial throughput will be about 20,000 bbl. daily, increasing ultimately to 60,000 bbl. daily.

The line runs southwest from the connection with the Interprovincial Pipe Line system at the Cromer pump station just across the border in Manitoba. It will tap production in Alida, Nottingham, Frobisher, Steelman, and Midale fields. Western terminal of the system will be at Midale field, A 7-mile spur will branch off the main line at Alida to gather oil at Nottingham field.

Capacity to fluctuate . . . Capacity of the system will fluctuate considerably from summer to winter (viscosity of Midale crude increases 5 times from warmest weather to coldest) and depending upon percentages of light and heavy crudes moved. Maximum capacity — when moving 100 per cent light crude in the summer—is about 100,000 bbl. daily.

The system will serve fields with proved oil reserves estimated last September at 43,310,000 bbl. and with probable reserves placed at 147,650,000 bbl. Proved reserves of 45,180,000 bbl. and probable reserves of 155,020,000 bbl. have been estimated for areas not served at present but within reach of the system in Saskatchewan and Manitoba.

Westspur's initial capital requirements were met in part with temporary bank loans and in part by issuing stock at $10 per share to the 16 participating firms. The company plans to issue $4,500,000 of first mortgage bonds to repay the temporary bank loans and provide the rest of the capital needed.



Owners . . . Owning companies and their interest in Westspur include Southern Production Co., Inc., 13,372 shares; Calvan Consolidated Oil & Gas Co., Ltd., 13,372; Canadian Gulf Oil Co., 13,372; Dome Explorations (Western), Ltd., 13,372; Imperial Oil, Ltd., 13,372; Royalite Oil Co., Ltd., 13,372; Woodley Canadian Oil Co., 13,372; Anglo-American Explorations, Ltd., 10,000; Canadian Devonian Petroleums, Ltd., 10,000.

Shell Oil Co., 10,000; Canadian Superior Oil Co. of California, Ltd., 8,000; Sun Oil Co., 8,000; Hudson's Bay Oil & Gas Co., Ltd., 6,000; Central Leduc Oils, Ltd., 4,800; Mobil Oil of Canada, Ltd., 4,800; and British American Oil Co., Ltd., 4,800.

This represents a total stock issue of 160,004 shares at a total cash investment of $1,600,040.

Imperial Pipe Line Co., Ltd., is in charge of design work and construction supervision. Contractor is Majestic Contractors, Ltd., Edmonton. The laying plan calls for one big spread of about 150 men to begin laying pipe at Cromer and work toward the Midale terminus.

Big Gas Line May Expand

WASHINGTON.—American Louisiana Pipe Line Co. is planning a 100,000,000 cu. ft. daily expansion of its still unfinished natural-gas system from southern Louisiana to the Detroit area.

The company has asked Federal Power Commission approval of a $16,075,000 project to increase the line's capacity to 400,000,000 cu. ft. The additional gas will be handled by building 35.8 miles of gathering lines and four compressor stations with a total of 42,000 hp., and adding 2,000 hp. at two of the three original stations.

All of the additional gas is to be sold to Michigan Consolidated Gas Co. and Michigan-Wisconsin Pipe Line Co.

The American Louisiana line will be finished in the next few weeks and will go into operation this summer. The expansion would be handled in two steps. About 65 per cent would be built immediately, to go into operation November 1. The remainder would go into operation July 1, 1957.

New Play in Texas?

Stanolind leases may launch Delaware-Val Verde drive

MIDLAND, Tex.—Oil company interest continues to mount in sparsely tested, but promising Delaware-Val Verde basin areas.

A Stanolind Oil & Gas Co. official verified last week his firm recently completed two deals for leasing 27,520 acres in Pecos County, about 20 miles southeast of Fort Stockton.

Company holdings in the basin have been meager, but some industry observers feel the Pecos County deals may be a tip off that Stanolind is planning a large-scale lease drive there.

In the latest and largest of the two deals, Stanolind paid a reported $10 an acre for 20,480 acres (32 sections) southeast of Fort Stockton and west of the Puckett gas area. The leases, acquired from Floyd and Roy Henderson, are for 10 years.

Stanolind earlier paid a reported $5 an acre for 7,040 acres (11 sections) to the west of the larger tract.

The 20,480-acre tract includes sections 37 and 38 in Block 135, T&StL survey, and Section 4 through 9 and 13 through 36 inclusive in Block 136, T&StL survey.

The 7,040 acres takes in sections 2, 8, 12, 14, 30, 35, and 36, in Block 37, T&StL survey.

Big Refinery Project Set

TOLEDO.—Standard Oil Co. (Ohio) will start clearing a site this winter for construction of new facilities, costing $35,000,000 to $40,000,000, at its 28,000-bbl. refinery here.

Construction is due to get under way early next spring, with completion expected in December of 1957. M. W. Kellogg Co., the contractor, is preparing engineering plans and ordering equipment. Preliminary engineering studies have been completed.

The project will be the biggest of its type ever undertaken by Ohio Standard. New units will be designed to operate on sour crude.

Much of the cost of the new project is expected to go for modernization.

Patman Bill Saved

Drive revived to modify "Detroit case" decision

WASHINGTON. — A new drive to modify the "good-faith" decision of the U. S. Supreme Court in the "Detroit case" involving Standard Oil Co. (Ind.), will be made in Congress next month.

A bill to restrict the good-faith defense against provisions of the Robinson-Patman Act has been held by a House committee since the first day of the 1955 session. Last week the necessary 218th signature was put on a petition to take control of the bill out of the rules committee so that it can be sent directly to the House floor.

House rules provide a formula for the timing of action on bills brought up by petition. The earliest date for action on the measure is June 11. Rep. Wright Patman of Texas, who wrote the bill and has headed the discharge move, said he will bring it up then. Otherwise it will have to lay over until June 25.

Patman's move to discharge his bill brought immediate reaction from the judiciary committee which he charged with sitting on the measure. It ordered a favorable report on an almost identical measure, sponsored by Rep. Byron G. Rogers of Colorado.

A quick hearing will be asked of the rules committee, and the Rogers bill may pass the House before Patman's discharge motion is in order.

Net effect on industry will be the same under either bill. But the Senate is not expected to act on the issue this year even if the House does.

The drive to get action on the Patman bill was sparked by this month's decision of the U. S. Circuit Court of Appeals at Chicago. That court 3 years ago supported the Federal Trade Commission's original order, but recently threw out its revised order. It ruled that Indiana Standard had not violated the antiprice discrimination act because it quoted lower prices in good faith to four customers in the Detroit area to meet the low prices of a competitor *(The Oil and Gas Journal, May 14, page 104)*.

Westpan Control Changes

NEW YORK. — Sinclair Oil Corp. last week completed the sale of its entire common stock holdings of Westpan Hydrocarbon Co. to Jaclo, Inc., of Dallas.

Sinclair sold 384,861 shares for $12.70 per share, receiving more than $4,800,000.

Westpan has various interests in the production of natural gas, natural gas liquids, and crude. Its headquarters are in Amarillo.

Sinclair was required to dispose of all its Westpan holdings under terms of a Securities and Exchange Commission order, based on the Public Utility Holding Co. act. Its holdings represented 53 per cent of the 727,757 outstanding shares of Westpan.

Louisiana Suit Filed

Brownell asks high court to suspend state injunction

WASHINGTON. — The fight over federal leasing within Louisiana's claimed 3-league boundary moved to the U. S. Supreme Court last week.

Atty. Gen. Herbert Brownell asked the court to halt Louisiana's effort to deal with the boundary controversy in its state courts. The suit is pending in the Supreme Court and should be settled there and nowhere else, he said.

This suit, filed this spring, would fix the state's boundary as 3 miles from the low-water line. Louisiana has until June 25 to reply to the Government's charges. The case will not be ready for argument, however, until next fall.

The department's latest move came as a result of an injunction issued by Louisiana Judge Mark C. Pickrel, halting the sale of leases by the Interior Department in New Orleans May 15 *(The Oil and Gas Journal, May 21, page 138)*.

Brownell said the injunction would make federal officials subject to contempt proceedings if they went ahead with the sale of leases. He asked the court to order the state proceedings suspended until after it has acted on the boundary issue, if it cannot permanently stop them.

Tax Challenged Again

DENVER.—The California Co. again is challenging Colorado's so-called severance tax on oil and gas production in a second suit filed in Denver District Court.

Calco, largest producer in Rangely field, brought action to recover $1,038,474 in severance taxes paid the state on its 1954 production. A similar suit was filed a year ago in which the firm sought the return of $947,430 paid for 1953. Both suits contend the levy is discriminatory and unconstitutional.

The Colorado attorney general's efforts to gain dismissal of the 1953 litigation on grounds the state is "immune and exempt from suit in its own courts" is now pending in the State Supreme Court.

Industry BRIEFS

KANSAS CITY. — Negotiations on provisions of a new labor contract got under way this week here between representatives of Sinclair Oil Corp. and the Oil, Chemical and Atomic Workers International Union. Sinclair agreed to 6 per cent wage boost last March. Other provisions of contract were delayed until June 15 when Sinclair's master agreement with O.C.A.W. expires.

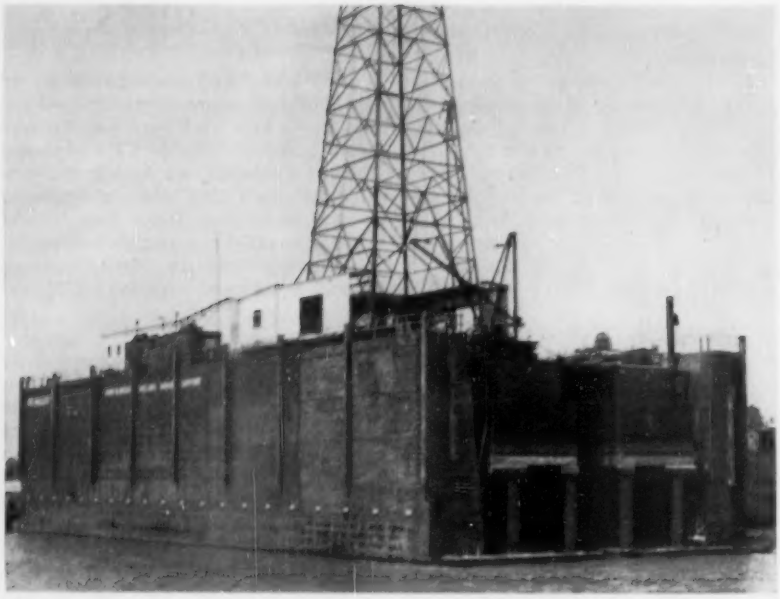
WASHINGTON.—Iroquois Gas Corp. has received Federal Power Commission authority to develop 8,500,000 M.c.f. in underground storage capacity in New York. The new natural-gas facilities will be in Chautauqua, Cattaraugus, and Erie counties. Iroquois will drill 16 wells, reclaim 64 depleted wells, build 22 miles of gathering lines, 14 miles of delivery line, and a 900-hp. compressor station. Cost will be $2,877,200.

TORONTO.—Merger of British American Oil Co., Ltd., and Canadian Gulf Oil Co. is complete. Final step was taken this month when 6,860,368 shareholders of B.A. voted approval. Only 31,592 opposed the move. Under terms of the merger, B.A. takes over the entire assets of Canadian Gulf. In the deal, Gulf Oil Corp. acquired 60 per cent of B.A.'s outstanding shares.

CALGARY.—Alberta producers sold 46,237,164 bbl. of crude for $113,138,071 during the first 4 months of 1956. If the pace continues, production this year will hit $340,000,000. This compares with $275,000,000 in 1955. But April totals were down considerably from the first 3 months, due to the strike at Shell Oil Co.'s Anacortes, Wash., refinery.

WILMINGTON, Del.—Final closing is scheduled here June 6 in the $200-million deal by which Atlantic Refining Co. will acquire oil and gas properties from Houston Oil Co. A series of preliminary documents was executed here last week by officials of the two companies. Other documents will be signed in Houston this week in connection with transfer of nonproducing properties.

WASHINGTON.—The Government has sold the last of its synthetic rubber plants. The big alcohol-butadiene plant at Louisville, Ky., will go to Union Carbide & Carbon Corp. for $3,125,000. Sale is subject to congressional approval and a lease now held by Publicker Industries, Inc., which runs until April 1958.



Dry Dock Floats Offshore Rig

HOUSTON. — A 1,400-ton floating dry dock, similar to Navy repair vessels of World War II, is now being used in the Gulf of Mexico to support a submersible drilling barge.

John W. Mecom, Houston independent oil operator, revealed last week that he is drilling his first well from the unusual unit in Block 45, West Cameron area, off the coast of Louisiana. The dry dock is 220 ft. long, 78 ft. wide, and has wing walls 48 ft. high. It can maneuver in water 10 ft. deep and is designed to operate in water as deep as 40 ft. Present operation is in 29-ft. water.

The dry dock picks up the drilling barge normally used in inland waters, moves it to location, and cradles it during drilling operations.

Mecom says the dry dock has distinct advantages in mobility, flexibility of operation, and quick evacuation. In event of storm, it can be raised from 30 ft. of water and moved within 90 minutes. The unit can be salvaged, and when not used to support a drilling barge it can serve as a repair base for offshore equipment.

The dry dock was built by Levingston Shipbuilding Co. at Orange, Tex., at a cost of about $800,000. The barge represents an investment of an additional $800,000. Tugs and other auxiliary craft bring the cost of the entire unit to more than $2,000,000.

Built of heavy steel, the dry dock has ⅞-in. bottom plates. The sides are constructed of ⅜-in. steel, and the work floor is of ⅝-in. plates. The decks will support barges used in drilling to 16,000 ft., Mecom says.

The craft can be submerged within an hour through use of eight deep-well pumps. The pumps, four located on each side, have a capacity of 3,000 gal. per minute each.

A 2-ft. skirt around the bottom of the dock helps anchor it to the gulf floor. Weight of the unit holds it in place. Wing tanks then may be used to store water or oil.

The barge now in use on the dock has living quarters for 24 men.

Lull in Road-Crossing War

HOUSTON.—Magnolia Pipe Line Co. has reached a temporary truce with Harris County, Texas, in the dispute over the right of a pipeline to cross county roads.

County Attorney Burke Holman reported that Magnolia had agreed to apply for a crossing permit through customary channels, but under protest.

The county had sought an injunction halting work on three crossings for which Magnolia had not sought permits. One of the pipes was removed under directions of County Commissioner V. V. Ramsey while the suit was pending *(The Oil and Gas Journal, May 14, page 111).*

Magnolia, like several other pipeline companies, contends the county does not have the authority to require permits for road crossings. A suit in a similar dispute between the county and Tennessee Gas Transmission Co. is now pending.

Waste Hearing Set

● Operators at Rangely field accused of violating conservation agreement

DENVER. — The Colorado Oil and Gas Conservation Commission has called a hearing June 25 to examine charges of wasteful oil-production practices in Rangely field.

Commission Chairman Warwick Downing called the hearing. He said if the wasteful practices are not stopped, Rangely's potential crude output will be cut by about 2,000,000 bbl.

The field is controlled by five major producers—Phillips Petroleum Co., Stanolind Oil & Gas Co., Sharples Oil Co., and a combine of Union Pacific Railroad, The Texas Co., and The California Co.

Agreement broken . . . The chairman charged that the producers have defied a conservation agreement reached last fall.

"They promised to get together and do a better job," Downing said, "but they haven't done it. On the contrary, they've increased oil production from 65,000 to 80,000 bbl. a day—nearly 25 per cent. The Rangely gas flaring has increased from 4,000,000 cu. ft. per day last fall to 30,000,000 cu. ft. now."

Downing conceded there is "bound to be some firing of gas in oil production," but said the situation in the Rangely field "has gotten way out of hand."

He added some companies are reinjecting gas into the Weber formation. but amounts are considered inadequate for proper conservation.

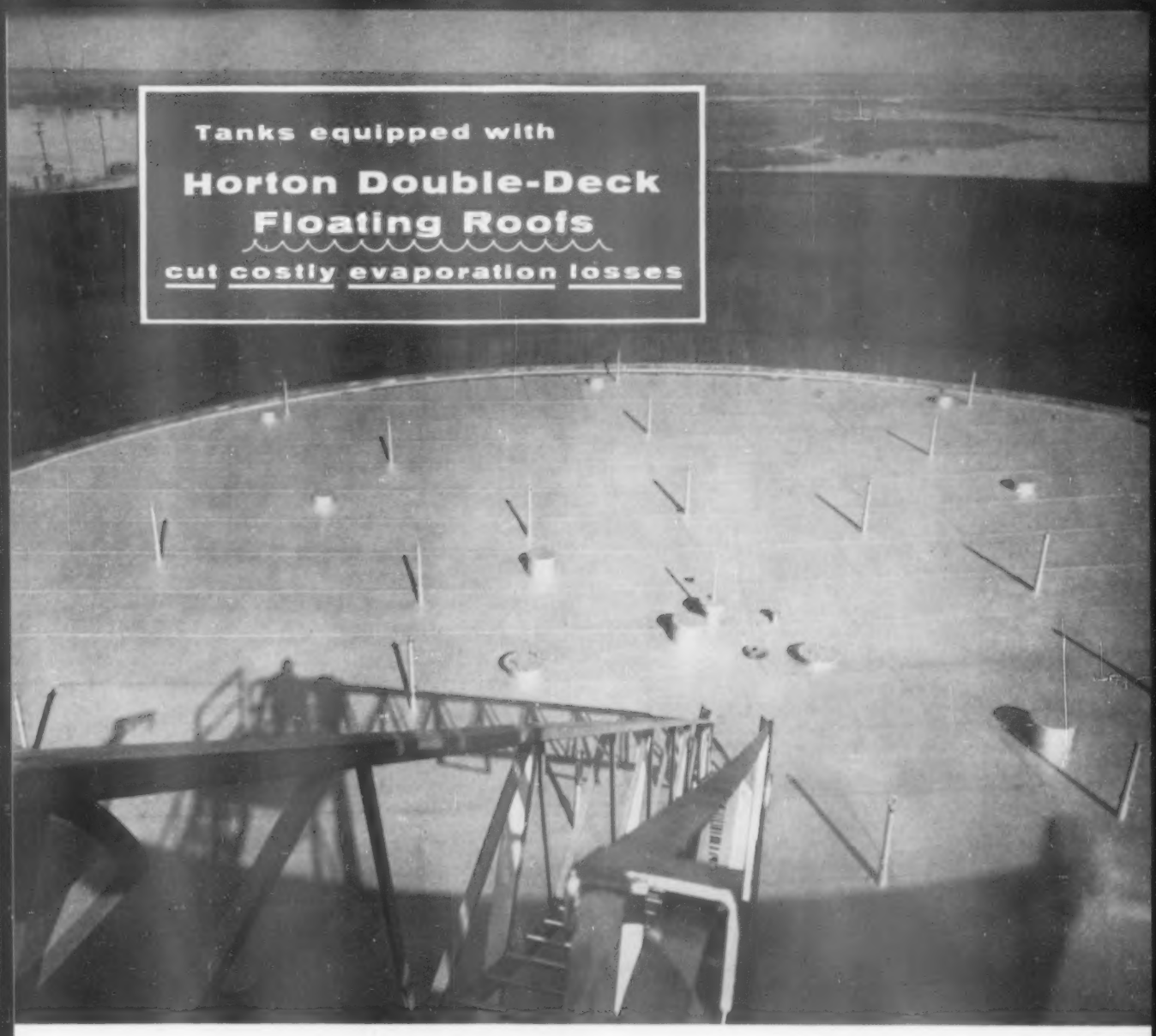
Solution . . . A commission order for greater reinjection, issued 4 years ago, was declared unconstitutional by the Colorado Supreme Court in May 1955.

The best solution to waste in the Rangely field, in Downing's opinion, is unitization of the 100 leases.

"We can't force them to unitize," Downing admitted, "but if they don't we'll have to adopt stringent measures for conservation."

The chairman was frank to admit, also, that he didn't know what course of action the commission will follow after the June hearing. He said, however, "we think we have ample authority under the law passed in 1955 which gives us the power to prevent waste and limit production."

Downing asked operators in the northwest Colorado field to reduce their production of oil by 10 per cent pending a decision based on the hearing.



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ODM Plan Challenged

Emergency pipeline proposal called impractical; Ryan says existing eastern crude lines won't meet war needs

WASHINGTON.—A tentative Government decision not to help build new products-pipeline capacity from the Gulf Coast to the eastern seaboard was challenged last week.

Paul Ryan, chairman of the American Pipe Line Corp., called the latest plan of the Office of Defense Mobilization impractical. Ryan's company had proposed one of the two products lines under consideration.

But the ODM currently favors creating a crude-oil concentration area in the east to operate in any emergency. It would link crude lines now serving the Ohio-Pittsburgh area into a concentration point and also could convert the wartime Big Inch Line from gas to crude oil.

Ryan declared these lines cannot provide the expected volume. He attacked the ODM program in a brief filed with Mobilization Director Arthur S. Flemming. The ODM plan was revealed last month in a staff memorandum which held that the Government was not justified in making loans or guarantees for building new lines to the area *(The Oil and Gas Journal, April 30, page 87)*.

The memorandum held that the 1,000,000 bbl. daily which would have to move overland if tanker transportation were halted in an emergency could be met by using present crude lines and converting the Big Inch.

Will it work? . . . Ryan contends the wartime oil needs of the East Coast are not limited to 1,000,000 bbl. daily of crude.

Actually, he said, there is a need for at least 3,000,000 bbl. daily of refined products. He added the memorandum ignored this. Ryan pointed out another omission in the memorandum was how the 1,000,000 bbl. daily of crude will be moved to the coast from the Ohio-Pittsburgh area.

"It is difficult to understand how anyone could confuse the presence of crude oil in that area with the need for refined products on the East Coast," Ryan said.

The presently available excess capacity of the lines running into the Ohio-Pittsburgh area is only 20,000 bbl. daily—not the 665,000 bbl. on which the memorandum was based, Ryan asserted.

Ryan estimated there would be a deficit of 1,115,000 bbl. daily of crude and products on the East Coast in a war emergency. He said this would be true even after utilizing all existing lines, barges, both Inch lines, tank cars, and a stray tanker or two.

He estimated it would cost the Government $107 million to get 677,000 bbl. daily of crude into the concentration area and another $65 million to move it to the coast.

In the face of that cost, Ryan said, it is absurd to say the Government is not justified in guaranteeing $35 million of the financing for a new products line to move 500,000 bbl. daily from the Gulf Coast.

Rival accepts . . . Texas Eastern Transmission Corp. which had a products-pipeline plan competing with American, accepted Flemming's proposal — but with reservations.

Texas Eastern already has Federal Power Commission approval to convert the Little Inch pipeline from gas to products. But this switch has been delayed at least until next year by an adverse federal court ruling. Texas Eastern proposes putting standby pumping capacity along the line for quick reconversion in event of an emergency.

American has held an ODM certificate of necessity for more than a year for its products line from Texas to the East Coast. This would allow rapid amortization of the cost. In addition American had asked for a government loan or guarantee of part of the financing because the line would serve the nation's emergency needs.

Texas Eastern Vice President J. W. Hargrove took exception to the ODM finding that the Big Inch could be converted without disturbing gas supplies to its present customers. He said the 300,000,000 cu. ft. daily now carried by the line could not be diverted through existing facilities. He explained there is no latent transmission capacity in other large systems that could take over the load.

Gasoline Consumption Climbs to New High

NEW YORK. — American motorists used more gasoline during 1955 than ever before in history. Consumption hit a peak of 54,333,000,000 gal., up 3 billion, or 6.3 per cent, from 1954.

Californians set the pace in fuel consumption again last year, burning a record 5,615,000,000 gal., up 360 million from 1954. The figure represented more than a billion-gallon bulge over Texas, second-biggest user.

Other states in the first five, and their consumption: New York, 3,515,000,000; Ohio, 2,913,000,000; and Pennsylvania, 2,846,000,000.

Kansas consumed 1,027,915,000 gal. last year to join 18 other states using over a billion gallons yearly. Among other large users, Tennessee and Oklahoma are fastest approaching the billion-gallon category. Every state but Texas posted a gain over 1954.

GASOLINE CONSUMPTION IN THE U. S.
(Thousands of gallons)

	1955	% change from '54
Alabama	826,043	8.3
Arizona	359,695	10.1
Arkansas	517,455	6.9
California	5,615,961	6.8
Colorado	595,459	4.8
Connecticut	672,868	6.0
Delaware	143,877	10.9
District of Columbia	207,137	3.1
Florida	1,373,086	11.3
Georgia	1,104,241	8.0
Idaho	249,839	4.5
Illinois	2,765,454	5.0
Indiana	1,641,182	7.6
Iowa	1,104,338	3.7
Kansas	1,027,915	5.2
Kentucky	778,836	7.3
Louisiana	838,359	13.6
Maine	292,568	6.3
Maryland	768,602	8.4
Massachusetts	1,213,461	8.0
Michigan	2,449,698	8.2
Minnesota	1,152,328	5.5
Mississippi	579,838	6.6
Missouri	1,544,227	5.3
Montana	276,356	3.3
Nebraska	568,258	3.3
Nevada	124,868	11.0
New Hampshire	172,206	6.6
New Jersey	1,806,414	7.7
New Mexico	336,343	8.0
New York	3,515,993	6.8
North Carolina	1,254,148	9.1
North Dakota	302,404	1.8
Ohio	2,913,859	7.6
Oklahoma	920,464	11.6
Oregon	620,310	5.3
Pennsylvania	2,846,509	6.9
Rhode Island	233,431	7.4
South Carolina	627,314	6.2
South Dakota	328,876	1.8
Tennessee	975,778	5.8
Texas	4,438,232	—0.5
Utah	293,999	9.6
Vermont	119,007	4.2
Virginia	1,155,198	8.9
Washington	868,968	7.6
West Virginia	461,372	7.1
Wisconsin	1,188,278	3.8
Wyoming	162,203	2.0
Total U. S.	54,333,255	6.3

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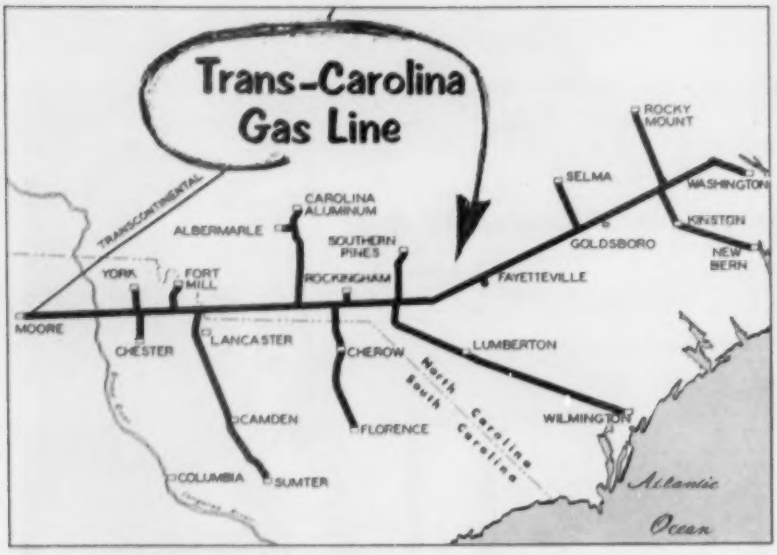

Gas Line Planned in Carolinas

FPC approval of $21-million project would bring natural gas to one of largest unserved areas on Atlantic seaboard

WASHINGTON. — Trans-Carolina Pipeline Corp. of Raleigh, N. C., has made its first move toward a $21,656,100 natural-gas pipeline project. Its application for authority to build has been accepted for filing by the Federal Power Commission.

The proposed line will bring natural gas to the coastal flatlands of the eastern Carolinas and a portion of the Piedmont extending roughly from Moore, S. C., to Monroe, N. C. This area is one of the largest along the Atlantic seaboard still without natural gas.

The system will consist of 280 miles of main line extending from near Moore through Rock Hill, S. C., and passing into North Carolina running near Monroe, Hamlet, Fayetteville, and Goldsboro, and terminating at Washington. The main line will range in diameter from 18 to 10 in. Several lateral lines will serve towns both north and south of the main line.

Trans-Carolina has contracted for up to 40,000,000 cu. ft. of gas daily. It will be delivered at Moore through a connection with Transcontinental Gas Pipe Line Corp. of Houston, Tex. The gas will be made available to Trans-Carolina in three stages: Initial volume of 10,000,000 cu. ft. in early 1957; and 20,000,000 cu. ft. at the end of August 1957; then the balance in November 1957.

Midwestern Accused of Raiding

WASHINGTON.—Northern Natural Gas Co. charged last week that Midwestern Gas Transmission Co. is trying to raid the market areas of other pipelines.

This was one of the several charges leveled at Midwestern's plan to import 200,000,000 cu. ft. daily of Canadian gas and buy another 200,000,000 from Tennessee Gas Transmission Co. for sale in the Northern Plains area. The plan is now under study by the Federal Power Commission.

Northern asked the FPC to dismiss the applications. It asserted the project is "uneconomic, lacking markets, revenues and financing," and is delaying service to the area by other companies.

The company made similar charges last December in another motion to dismiss. The motion was denied on the ground it was premature. The FPC, however, said the allegations would be considered later.

"The Midwestern project is founded upon and dedicated to the principle of forcible invasion of the market territories of other pipeline companies," Northern charged. "Midwestern confronts these companies with the following alternatives: either buy gas from Midwestern and thus subsidize the line —or refuse and suffer the consequences, a market raid."

New Refinery Sought

Legislation may clear way for Richfield-Indians deal

WASHINGTON. — Legislation clearing the way for Richfield Oil Corp. to buy a big refinery site on the Tulalip Indian Reservation in Washington is expected to be offered Congress soon.

Richfield has selected a 900-acre site on Port Gardner Bay for future development. The Indians' tribal council favors the sale.

Legislation is necessary to put the deal through, particularly because of a confused ownership situation.

The site includes what is known as allotted land. Years ago, these lands were granted to individuals. The original owners died and the lands were divided among their heirs. It is figured that some 300 individual titles will have to pass to give Richfield the block.

Sebastian Williams, chairman of the tribal council, discussed the matter in Washington last week with Interior Department officials and members of the Washington congressional delegation.

Richfield officials have indicated they have no immediate plans, but reports were that a $50,000,000 refinery may be built on the reservation.

Court Settles Spacing Tiff

WASHINGTON.—A U. S. Supreme Court refusal to review a Texas court decision may settle a knotty problem arising under the spacing provisions of the state oil conservation law.

The court refused to review the case of Ryan Consolidated Petroleum vs. Pickens in which the state supreme court held that the owner of land next to a tract on which a well is drilled has no right to share in the profits from the well.

The Ryan company, which owned lots next to the Pickens property, sought "equitable compensation" when the Texas Railroad Commission ruled that the only well should be drilled on the Pickens property.

Texas Lands to Be Leased

AUSTIN.—The Texas School Land Board will put up nearly 100,000 acres of onshore and submerged Texas lands for oil and gas leasing July 3.

The total takes in roughly 74,000 acres of bays and islands; 18,000 acres of Gulf of Mexico lands; 4,300 acres of river, bayou, and lake beds; and 1,000 upland acres.

Minimum bonus is $15 an acre and annual rental $3 an acre. All leases will reserve one-sixth royalty.

Nalco TREATMENTS

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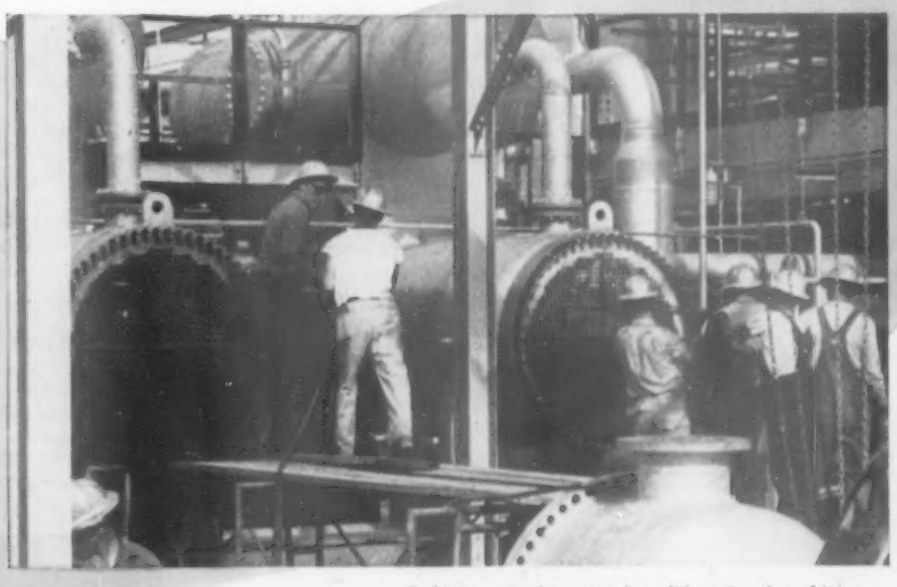

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Neutral Zone Drilling Slated

● Getty Oil hopes to triple production in Middle East concession; some crude to go to big Tidewater refinery

GETTY OIL CO. has launched a stepped-up drilling program aimed at more than tripling oil production in the Kuwait-Saudia Arabia Neutral Zone.

By the end of the year the company hopes to:

... **Increase production** to 100,000 bbl. daily from present 30,000 bbl. daily on the concession along the Persian Gulf it shares with American Independent Oil Co.

... **Exploit a deeper pay** zone uncovered nearly 2 years ago.

... **Supply Tidewater** Oil Co.'s new 130,000-bbl. daily refinery at Delaware City with part of its crude requirements.

... **Step up fuel oil** shipments to the fast expanding European market.

New equipment . . . Getty officials last week took delivery in Tulsa of a new trailer-mounted Franks drilling rig as part of their program.

The rig is one of the largest of its kind ever made by Franks. It is a Franks Comet 75, rated at 7,500-ft. drilling-depth capacity. The 102-ft telescoping derrick, draw works, and power plant are mounted on one trailer. The substructure, runway, pipe racks, and rotary table are on a second trailer. And the mud pump and electric-generator are on a third.

W. J. Scott, general manager of the Getty interests, said the fast, portable rig was ideally suited to Neutral Zone conditions and the company's plans. The new rig was freighted to Houston where it will leave by ship June 6. It should be on location in the Neutral Zone late in July.

Another rig, a Franks 35, has already arrived in the Neutral Zone. It was rebuilt at Franks' Tulsa plant before being shipped. The rig, with a 3,500-ft. depth capacity, is being rigged up for shallower work. The company also has on location a small outfit—used principally for core drilling—which has been drilling 1,800-ft. wells. Scott said this rig may be replaced also with newer shallow-drilling equipment.

Production is aim . . . The new rig will be used to drill to the Ratawi zone of the Neutral Zone's Wafra field.

The Ratawi is found at 6,445 ft. It was discovered in 1954, but the discovery well has been shut in because of junk, and the zone has not been produced. Neutral Zone production comes from shallower sands, mainly the Burghan at 3,550 ft. and an even shallower 1,800-ft. sand.

Searching for the Ratawi zone has come up with another important economic factor. Everywhere in the concession where the deep zone has been tested, production also has been found in the shallower zones, even where the Ratawi has been dry. This feature, Getty officials said, will make it possible to drill for the Ratawi and plug back for shallower production if it is dry.

Production on the concession has barely passed 30,000 bbl. daily from 32 wells, all in the Burghan or shallower sands. Getty hopes to step this up to 100,000 bbl. daily by the end of the year through its drilling program. Scott said the new rigs will be assigned to a constant drilling program, adding: "We'll punch down as many wells as we can."

New refinery . . . The Neutral Zone crude is low-gravity, high-sulfur oil which requires special handling in processing.

The oil brought up from 1,800 ft. has a 12°-gravity while crude from the Burghan is rated at 24°-gravity and the Ratawi at 25-gravity. By blending them and stripping some of the H_2S in the field, the crude is upgraded. It finds a ready sale in the European fuel-oil market.

One impelling factor in the stepped-up Neutral Zone production program is the new Tidewater refinery now nearing completion at Delaware City. The big plant is designed to operate on Middle East crude.

J. Paul Getty interests which own Getty Oil also hold a major block of Tidewater stock. George Getty II, a son, recently was transferred from Tulsa to become eastern general manager for Tidewater. The Gettys privately are known to be unhappy that the big Tidewater refinery is about ready to go on stream without enough Neutral Zone crude to supply its needs.

Among new refining units Tidewater is reported installing in the new plant as a catalytic hydrodesulfurization unit to process sour crude *(The Oil and Gas Journal, May 14, page 100)*. This would make Neutral Zone crude fit ideally into the refinery scheme.

But the Gettys also are reported anxious that the full potentialities of Neutral Zone reserves be tested. Latest

RIG FOR NEUTRAL ZONE drilling program is accepted by W. J. Scott (right), general manager of Getty Oil Co. He is shown examining the control panel of the trailer-mounted equipment with Stuart Corry, sales manager of Franks Manufacturing Co., the builder.

estimates of reserves for the area were 500,000,000 bbl. But some officials in the company feel there is actually more oil in the concession than the operators will be able to extract during the 66-year duration of the agreement.

New policy . . . The Getty drilling program may be a tip-off to a shift in operating policy for the Neutral Zone.

American Independent, which shares the concession on a 50-50 basis with Getty Oil, in the past has been the operator. Aminoil reportedly has two rigs of its own in the concession. Arrival of two Getty rigs indicate the companies now will share development work in an effort to increase production.

The Neutral Zone is a small wedge-shaped desert area on the Persian Gulf between Kuwait and Saudia Arabia and is owned jointly by the two companies. Pacific Western Oil Corp., now Getty Oil, obtained a concession in 1949 for the undivided half-interest belonging to Saudia Arabia. The concession covering Kuwait's undivided half interest was granted to Aminoil in 1948.

Aminoil transports its crude through a 34-mile, 8 and 10-in. pipeline running northeast to Mena Abdulla in Kuwait. Getty crude is carried eastward to Mena Saud terminal in the Neutral Zone.

Hamburg Refinery Expanding

Deutsche Shell A.G. has started work on the main project of a $60-million expansion program at its Hamburg-Margurg refinery.

The plant will be expanded from 19,500 bbl. daily to about 56,000 bbl. daily. The project is scheduled for completion in 1958. A 2,300-bbl. daily catalytic reformer is scheduled to go on stream by midyear. An 8,000-bbl. daily gas desulfurizer will go into operation during the third quarter.

R.A.G. Drilling Near Alps

R.A.G., joint Socony Mobil Oil Co., Inc., and Royal Dutch-Shell Co. in Austoria, has a 2-rig drilling program under way near the foothills of the Austrian Alps.

The company is drilling on an 820,000-acre concession near the German border. The concession, along with another 280,000 acres on the Yugoslav border, was obtained last year.

Two tests have been started so far. Puchkirchen 1, located about 30 miles east of Salsburg, was bottomed in basement at 8,500 ft. A minor show of light gas and oil was encountered at one horizon. Tests are continuing.

Bad Hall 1 is about 25 miles east of the first test. The well is at 4,900 ft. There have been small gas shows.

Philippine Wildcat Finds Show

THE first deep test ever drilled in the Philippine Islands has found a show of oil.

Philippine Oil Development Co. is drilling the well in the Cagayan Valley of northern Luzon. It is located in about the center of Isabela Province, which lies along the northeastern coast.

The show was encountered at 9,026 ft. At that depth the weight of the mud dropped from 114 lb. to 99 lb., indicating some sort of dilution. Drilling mud showed rainbow colors, and cuttings from the bottom indicated the presence of oil. Cores will be taken.

Podco plans to continue drilling to a projected depth of 12,000 ft.

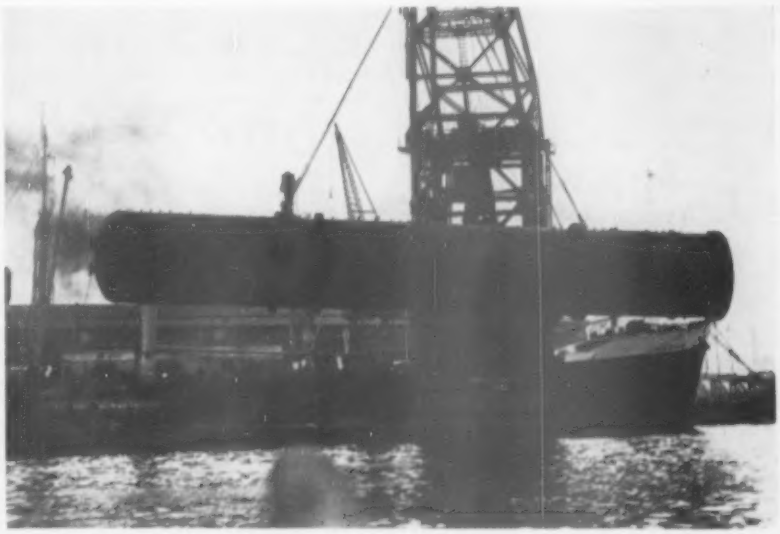
The well is on acreage which Podco holds exclusively. The area originally was disputed with Standard-Vacuum Oil Co. because of overlapping applications.

When the dispute was settled last year, the contested area was divided into three parts. One part, on which the well is located, was granted exclusively to Podco. Stanvac and Podco each received one of the remaining parts and a cross-option arrangement was worked out *(The Oil and Gas Journal, July 11, 1955, page 104)*.

Subsidiaries of Standard Oil Co. of California and The Texas Co., which hold acreage in the area on a one-half undivided interest basis, have a joint development agreement with Podco.

If the present well should find commercial production, each company has the option of taking 25 per cent of the production. In return, they would pay a total of 75 per cent of development costs in the discovery field only.

In other Podco areas, the companies have the option of obtaining 25 per cent interest each in return for paying 50 per cent of the costs *(The Oil and Gas Journal, May 14, page 121)*.



Giant Refinery Column Goes to Venezuela

THE biggest refinery column ever built in the United Kingdom is going into Cia. Shell de Venezuela's new 35,000-bbl.-daily catalytic cracking unit at Cardon.

The 147-ton column is 141 ft. long and 19 ft., 2 in. in diameter. It was floated down the Thames River from Greenwich to King George V dock for loading aboard a vessel.

The new cat cracker and alkylation units are under construction at Cardon. In addition, the Royal Dutch-Shell affiliate announced recently that it plans to add a fourth distillation unit with 80,000-bbl.-daily capacity to the Cardon refinery. The new distillation unit will boost the plant's crude capacity to 245,000 bbl. daily.

An auxiliary project already under way for Cardon is the construction of a 177-mile, 20-in. natural-gas pipeline from La Paz field in the Maracaibo district. The new gas line, which is expected to be in operation next year, will furnish all the fuel needed for the big refinery *(The Oil and Gas Journal, December 19, 1955, page 60)*.

IT TAKES MORE THAN KNOW-HOW . . .

An athlete needs good equipment to be a champion.

The drilling contractor, too, needs good equipment to continue his remarkable record. In 15 years his costs have risen 97%—and the producer's drilling prices have actually been reduced.

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Stanvac Spuds Wildcat

West Pakistan ceremony launches Indus Valley oil test; three other firms reported also ready to start drilling

STANDARD-VACUUM OIL CO. started its first well in West Pakistan last week, highlighting a growing interest in exploration in the area.

The wildcat, located about 130 miles east of Karachi near Jhudo, was spudded in at ceremonies led by Habib Rahmatoola, minister of industry. It is in the Indus River Valley on one of Stanvac's two 5,000-sq. mile concessions in West Pakistan.

The government holds a 25 per cent interest in the operation *(The Oil and Gas Journal, April 23, page 94)*. South Eastern Asia Drilling Co., Dallas, is the drilling contractor.

Other drilling . . . Three other companies, two British and one American, are soon due to start wildcats in widely scattered sections of West Pakistan.

One deep test will be drilled in the capital itself. A British firm, Pakistan Petroleum, Ltd., a Burmah Oil Co., Ltd., subsidiary, will drill the well. Operations were scheduled to begin this month on government-owned land near Jail Road. The location was a second choice, selected because the original choice was on private land.

Another British firm, Pakistan Oilfields, Ltd., is moving a rig to Hatla in Minanwali district. The test will be located about 30 miles southwest of Jhelum district, where a wildcat recently found a possible field deeper than any now producing in the country *(The Oil and Gas Journal, March 5, page 81)*.

The other American firm, Hunt International Oil Co., plans a test about 80 miles west of Karachi.

P.P.L. also planned to start a well this month at Sylhet, in the northwest corner of East Pakistan. The company is setting up a rig capable of going to 15,000 ft. for its second test in the area. The 1 Sylhet hit a high pressure gas formation at 7,800 ft. last May *(The Oil and Gas Journal, June 20, 1955, page 79)*.

Stanvac also holds a 10,000-sq. mile concession in East Pakistan. It plans to start drilling operations there about the end of next year.

Delay in India . . . Meanwhile in neighboring India, Stanvac has notified the government that drilling in West Bengal basin will be delayed at least 8 months.

The postponement is due to failure of survey teams to locate conventional rock structures. Stanvac crews are now engaged in the more difficult job of trying to locate stratographic traps. Drilling was expected to begin this month.

Stanvac obtained its 10,000-sq. mile Indian concession in 1953. It acquired its Pakistan concessions in 1954. The company has about 10 exploration crews working in the two countries.

India buys Soviet rigs . . . The Indian Government, which has indicated it plans to do extensive exploration work on its own, has ordered two rigs and other equipment costing $1,554,000 from Russia. Delivery will be made this year.

The deal follows the recent survey of India by Russian experts. Under the arrangement, the Soviets will set up the outfits at no cost. Forty-four Russian technicians will then train Indian crews for 6 months for a total cost of $220,000. Seismic equipment and two shot hole rigs also were purchased.

The rigs will be used in the Punjab and Rajasthan regions of Western India *(The Oil and Gas Journal, May 7, page 102)*.

Soldiers Guard Rig From Bandit Forays

A drilling rig with a built-in army post.

Such is the boast of a Kern Drilling International Co. rig operating in the Cagayan Valley, northeast Luzon.

Shortly after the Long Beach, Calif., firm started a wildcat in this rugged country for the Philippine Oil Development Co., a series of raids by native bandits hit the project. The growing threat of annihilation brought a quick call to the Philippine government for help. The government responded by sending a troop of constabulary on permanent assignment of guarding the drill site.

Location of these operations is 25 miles off the northeast coast of Luzon in the province of Isabella. This is about 200 miles north of Manila and only 300 miles south of Formosa.

Grace in Libya Deal

Buys big minority interest in Texas Gulf subsidiary

W. R. GRACE & CO. has gone a step further into the oil business by taking a big minority interest in the Libyan venture of Texas Gulf Producing Co., Houston independent.

Gordon W. Reed, Texas Gulf chairman, said that Grace acquired a large, but less than one-half interest in Libyan American Oil Co., a Texas Gulf subsidiary.

Under the arrangement, Texas Gulf will retain management of the company, while the role of Grace will be largely financial. The international chemical, shipping, mercantile, and banking firm is putting up $7,500,000 to finance Libyan American operations.

Second deal . . . Grace's entry into Libyan American is its second move in recent weeks into the oil industry. Last month, Grace announced its merger with Cosden Petroleum Corp. It will pay the equivalent of $55,000,000 for the integrated oil and petrochemical firm *(The Oil and Gas Journal, April 30, page 83)*.

Libyan American has a concession of over 25,000,000 acres in six areas in Libya. It is one of 13 companies recently granted concessions there.

Libyan American is drilling a well in the Gerdesel Abid section of Cyrenaica. The test is down to 1,000 ft. and is in Cretaceous.

Santa Fe to Drill in Iran

Santa Fe Drilling Co. will handle an exploration and drilling program in Iran that is expected to get under way the second half of 1956.

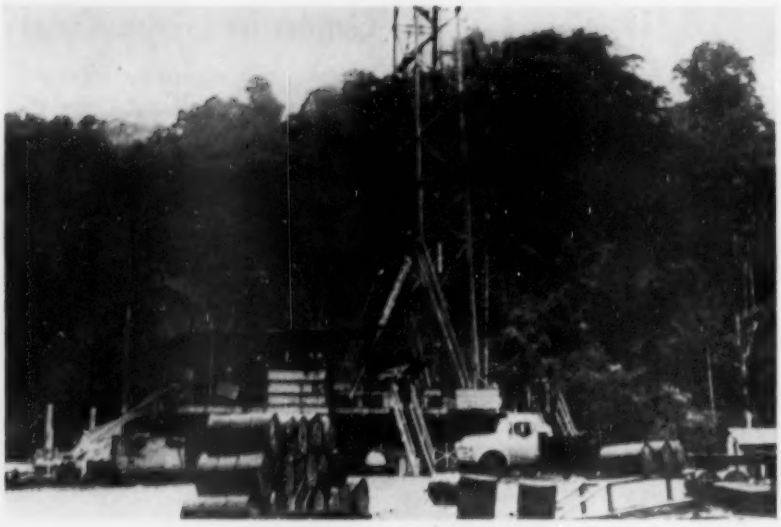
The firm was employed by Iranian Oil Exploration & Producing Co., one of the two companies operating the Iranian oil industry under the consortium agreement.

Tapline Faces Solid Front

Three of the four Middle East countries offered a 50-50 profit split by Trans-Arabian Pipe Line Co. will present a united front in coming negotiations.

The countries, Lebanon, Jordan, and Syria, also are expected to try to reach an agreement with the fourth country, Saudi Arabia, before talks begin.

Tapline earlier this month offered to change to a profit-making company and to split profits with the four countries. They would receive a total of about $16,000,000 a year *(The Oil and Gas Journal, May 14, page 116)*.



Central America's First Producer?

UNION OIL CO.'s 1 Cocoles is currently drilling near 8,500 ft. after finding two shallower sands that may make it Central America's first commercial oil producer. Drilling plans call for testing formations to 10,000 ft.

The drilling rig and crew of Loffland Brothers are shown on the 1 Cocoles location deep in the Costa Rican tropical jungles near the Panama border. Drilling operations often are hindered by heavy downpours that isolate the well from civilization for weeks at a time. Jungle animals and poisonous snakes are other hazards.

Union reported possible pay zones were encountered at 5,450 ft. and 6,400 ft. The first sand was 114 ft. thick. The second recovered oil of "excellent quality." Both were sealed off and drilling continued *(The Oil and Gas Journal, April 16, page 138)*. Union plans to offset the wildcat.

Swiss Interests Organize for Oil Hunt

SWITZERLAND is again attracting attention as a prospective exploration area.

Swiss interests have formed a prospecting and exploration group. It is headed by Schmidheiny of Heerbrugg and includes Sulzer Brothers, Inc., of Winterthur, George Fischer, Ltd., of Schafthausen, and NOK - Nordostschweizerische Kraftwerke, electric power and gas utilities. The group is ready to start activities immediately and plans to spend about $2,800,000 on its initial program. A German drilling contractor is participating with about $700,000.

The firm, MOFAG—Molasse Erdol-Forderungs A.G.—conducted seismic tests for 2 months late last year near Geneva and carried on surface work near Mendrisio, in the Canton of Ticino.

Oil code progress . . . At the same time, a number of Swiss Cantons appear to be making headway in adopting a uniform petroleum code. The Cantons of Zurich, Bern, Solothurn, St. Gallen, Aargau, and Thurgau have drawn up an agreement which awaits ratification by the individual governments. St. Gallen has given final approval. Zurich is holding a referendum on the code this month.

The petroleum code gives preference to Swiss interests, and provides that 75 per cent of the capital of any licensee must be Swiss.

There has been sporadic interest in oil exploration in Switzerland since the 1930's. A wildcat started in 1952 at Altshofen in Luzerne, financed by Basle interests, found minor oil shows at about 4,200 ft. and at 6,834 ft.

British Petroleum Co., Ltd., showed interest in the country in 1952 by forming a Swiss affiliate which carried on geological and geophysical work in Canton of Fribourg. The Swiss Commission for Oil Research had originally investigated the area in 1935-36. Three citizens took out a concession there in 1939, but their program was not followed through.

International BRIEFS

Russia has offered to barter oil for tankers with Italy. Beginning July 1, the Soviets have proposed exchanging about 11,000,000 bbl. of crude and 3,400,000 bbl. of fuel oil in return for five 18,000-ton and five 5,000-ton tankers.

Swiss interests are sounding out Italian authorities on the possibility of extending the Genoa - Rho pipeline to Locarno and Berne, Switzerland.

The 12-in. line supplies crude to the 45,000-bbl. Condor refinery near Milan. The Swiss would help finance the line, as well as a new oil terminal at Genoa which could accommodate eight tankers at once, three of them up to 45,000 tons.

The second European company in a month has been licensed to use the new Phillips Petroleum Co. catalytic process for making polyethylene and other polyolefin plastics. Phillips has licensed Badische Anilin & Soda Fabrik (BSAF) to use the process exclusively in Germany. Recently Phillips granted a license to Societe Solvay et Cie., Belgian firm for use in Italy *(The Oil and Gas Journal, May 14, page 121)*.

Pemex is now marketing 90-92 octane gasoline from its 100,000-bbl. Atzcapotzalco refinery at Mexico City. The price is 30 cents a gallon. In another development, Pemex is preparing to open a 47½-mile crude pipeline from Angostura field to Veracruz.

Istanbul Natural Gas Co., Ltd., is drilling a wildcat about 90 miles west of Istanbul in Turkish Thrace. The firm, which is associated with Ralph M. Parsons Co., is the company which built the new 7,000-bbl. refinery at Batman.

Germany's first Unifining unit and fourth Platformer have gone into operation at the refinery of Gewerkschaft Erdol-Raffinerie Deurag - Nerag. The Unifining unit has a capacity of 1,400 bbl. Capacity of the Platformer is 3,000 bbl. It is designed to produce 90 clear research octane blending compound, processing heavy straightrun naphtha.

The engineering division of the Societe Belge de L'Azote et des Produits Chimiques du Marly (S.B.A.) will design and build an ammonium nitrate granulation plant for Potasse & Engrais Chimiques (P.E.C.) at Grand-Couronne, France. The granulation plant will be based on a process developed by S.B.A.

TYSCO

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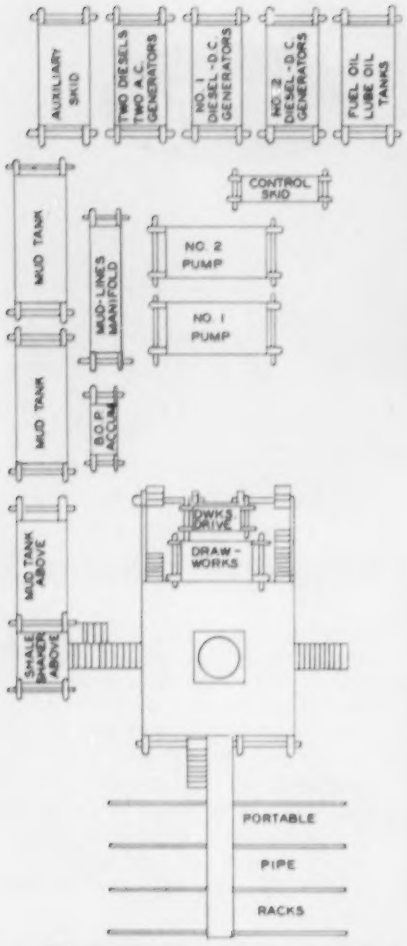
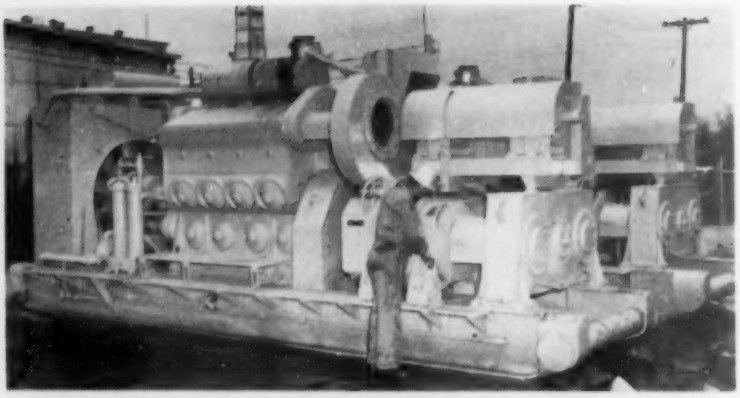
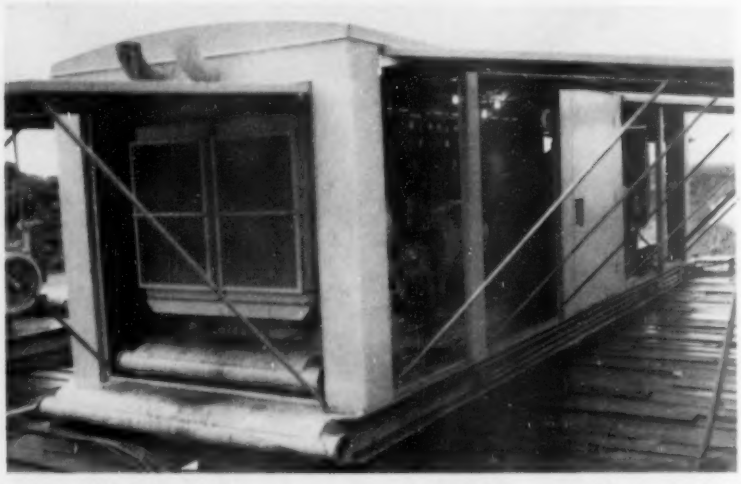


SKID-MOUNTING of all major equipment into the packages shown here provides easy moving and fast rigup. Fig. 1.



DRILLING POWER comes from these two diesel-engine-driven generator sets. Each 875-hp. engine drives two 502-kw. d.c. generators and will operate at three different speeds. Fig. 2.



AUXILIARY EQUIPMENT runs on a.c. power from this power unit. Here each of the two twin diesel engines drives a 160-kw., three-phase a.c. generator. Fig. 3.

Sun's Big New Diesel Rig Has

One of the most highly portable big rigs yet put in service on the Gulf Coast has just gone to work for Sun Oil Co. The rig is a diesel-electric that has the flexibility of a steam rig plus the fuel economy of a power rig. Moreover, Sun has assembled all major equipment into convenient skid-mounted packages for easy moving and fast rigup.

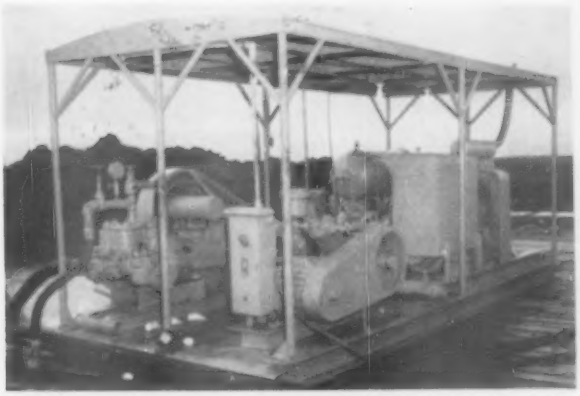
by Ed McGhee
District Editor

DRILLING contractors and operators everywhere like the flexibility of a steam rig. On the Gulf Coast where fuel gas and boiler water are plentiful, many steam rigs still operate. For deep drilling, power rigs get the nod only because of their better fuel economy.

When Sun Oil Co. decided to buy a new deep-well rig for the Gulf Coast, it picked diesel-electric power. The company felt that this drive has most of the advantages of both steam and power operation. Draw works and pump drive is as flexible as on a steam rig and so is placement of equipment. In fact, Sun men say they can do anything with their new Rig 15 that they could do with a steam rig except jet the cellar. Moreover, fuel costs are less than on a steam rig and there will be no time loss in laying steam, water, or gas lines to boilers.

On its first location in Nome (Texas) field, Rig 15 reached 6,000 ft. only 3 days after drilling out from under the surface pipe at 1,032 ft.

Because the electric power is transmitted by flexible conductors, Sun has been able to gather almost all rig equip-



UTILITIES such as water pump and air compressor operate from this skid. Battery-started engine with generator provides power to start big engines. Fig. 4.

SWITCHING controls on this skid set each engine, generator, and motor into operation. Driller then regulates operation from rig floor. Fig. 5.

MUD PUMPS on the rig operate on the power of two 625-hp. d.c. motors for each pump. Both 7¾ by 18 pumps have pulsation dampeners and automatic-resetting pressure-relief valves. Fig. 6.

Flexibility, Portability

ment into skid-mounted packages. There are very few loose pieces to be handled during moves. Even the mud lines connecting pumps and pits have been unitized onto a skid. The Ideco E-2500 draw works is rated for over 20,000 ft. But in spite of this big capacity, Sun expects to be able to make a "highway move" with the rig and commence drilling a new hole on the following day after moving starts.

Fig. 1 shows the layout of the packages as they are placed on a normal location. For "problem" locations, this arrangement can be varied to suit the need at hand.

Engine generators . . . Drilling power for Rig 15 is supplied by two separate diesel-engine-driven generator sets. Sun expects to add a third set later on to increase the flexibility still more. Each set has a V-8, two-cycle, 875-hp. full diesel driving two 502-kw. d.c. generators. The engine-and-generators package is essentially the same that General Motors has for several years manufactured for railroad power. The 8-567-C engines drive into a gear case and two generators are driven off this case with a 1.66:1 speed ratio. All the d.c. generators are interchangeable one with the other.

The engines operate at three different speeds according to the power required of them. At low load, they run at 425 r.p.m.; at higher loads they run at 675 r.p.m.; and at full load they reach 835 r.p.m. The rating of 875 continuous horsepower is at the highest speed. Fig. 2 shows one of these packages.

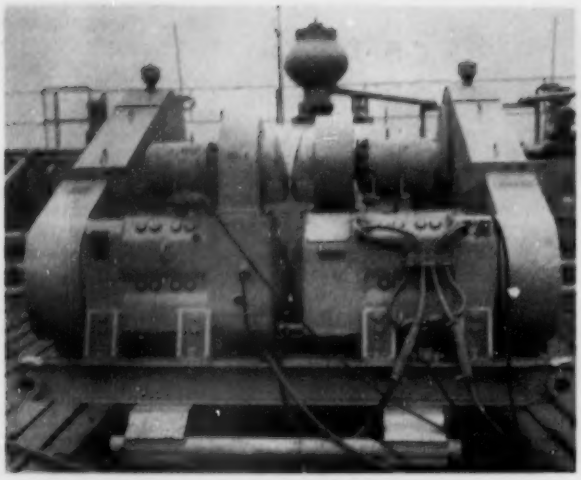
A.c. generators . . . Fig. 3 is the a.c. power unit. This skid mounts two twin GM 671 diesel engines, each driving a 160-kw., 40-volt, three-phase a.c. generator. These generators can operate singly or together to furnish the rig with power for either of two important purposes. First is the auxiliary load of operating the water pumps, mud mixers, shale shakers, fans for cooling the big motors, rig lights, and the like. Second, the a.c. is transformed to 120-volt single phase and used to control the big d.c. generators and as separate excitation of their exciters.

Utility skid . . . Sun's gathering of the rig's utilities made the convenient package shown in Fig. 4. It carries a 4½ by 6 water pump driven by a 20-hp. a.c. motor. There is also a 15-hp. electric-motor-driven air compressor and an air reservoir tank. For use in emergencies and in getting up power on new locations, the utility skid carries a battery-started 2-71 diesel engine that drives a 10-kw. a.c. generator, and a 15-hp. air compressor. Either or both loads may be carried simultaneously. Since all engines except this one are air started, this unit will provide enough air to start the auxiliary generator which furnishes power for the electric-driven units.

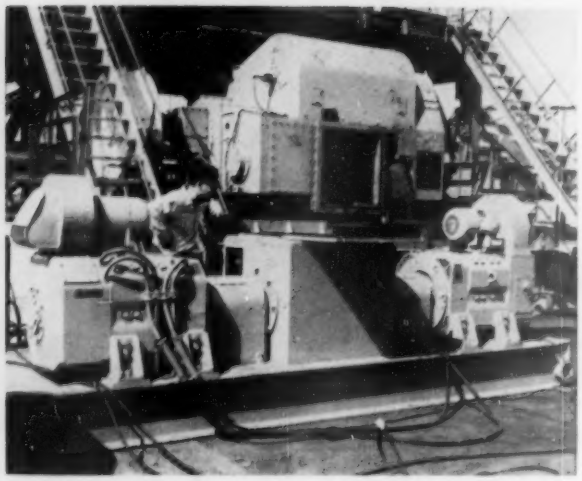
Control, starter skid . . . Although the driller controls the actual operation of the engines, generators, and motors from the derrick floor, starters and switch-gear for this equipment is grouped on the skid rack shown in Fig. 5. The housing is weathertight and the unitized arrangement makes for fast moving.

Motor-Driven Equipment

On Sun's new rig there are seven GM D-39M 625-hp. electric motors driving equipment. There are two on each mud pump, two on the draw



PUMP POWER is extremely flexible because each electric motor operates independently. If repairs are needed on one side of the drive the pump can keep operating. Fig. 7.



DRAW-WORKS DRIVE is separate skid package. For rigging up, only the chains and guard connecting each of the 625-hp. motors to the draw works must be made up. Fig. 8.

works, and one on the catworks rotary unit. These motors are interchangeable one with the other, and the armatures from them are interchangeable with those of the four GM D-39G generators. Each of the motors has a 500-watt space heater within it that stays on at all times to keep the motor dry and to prevent condensation.

Each of the motors also has mounted on it a 7½-hp. three-phase electric motor driving a 2,600 cu. ft. per minute blower for cooling.

Pumps . . . Fig. 6 shows Rig. 15's pumps. They are 825-hp. 7¾ by 18 GR-GXR Gardner-Denver, each driven by two of the 625-hp. d.c. motors. Fig. 7 shows how the two motors are independently connected to the pump through chain drives. With this arrangement, one motor can drive the pump from one side while, if necessary, the crew works on the other motor or chain drive. The pumps are also equipped with Hydril pulsation dampeners and Kinzbach automatic-resetting pressure-relief valves.

With these large pumps, Sun's drilling men don't expect they will have to compound the two together. But if it should be necessary, the variable-speed characteristics of the d.c. drive should help in doing it.

Draw works at truck level . . . Fig. 9 shows how Sun has placed the Ideco E-2500 draw works so that it is at truck-bed height. Such a mounting saves time in rigging up since the heavy draw-works skid need not be raised atop a high substructure as with the convention placement. When the draw works was brought onto the first location, it was spotted onto the substructure in about 20 minutes.

This draw works has four speeds to the drum and is equipped with air-operated jaw clutches; it is especially adapted for electric drive. The drilling line is 1⅜-in. diameter and there is a core reel wound with 20,000 ft. of ⅞-in. sand line. The drilling line feeds through a hole in the derrick floor and the sand line passes just outside the floor's edge.

Instead of a conventional dynamatic brake, the draw works has experimental electromagnetic brake that can act as an automatic driller. It is smaller and lighter than a conventional dynamatic and requires outside electric power for its operation. Inside its case are a stator and rotor with an air gap between, and this gap contains iron filings. When the field is energized, these filings are magnetized and "grab," thus slowing the turning of the rotor. The greater the excitation of the field, the more the filings are magnetized, and the more the rotor will be slowed. Since the rotor is directly connected to the draw-works drum, the drum is thus braked.

If the excitation is great enough, the rotor will be stopped entirely; in this way, the brake can be made to act as an automatic driller as well. The driller sets the controls so that the rotor will not turn until the fast line pull goes above a preset amount. In this way, the line is slacked off just enough to keep a constant weight on the bit as it drills ahead.

Because the weight of the draw works and brake approach highway limits, Sun made the drive for it a separate unit. Fig. 8 shows the two while being assembled on the first location. This drive consists of two 625-hp. motors, shafts, and sprockets for driving the draw works through two sextuple chains. The chains and their guards are the only connection to be made or broken between draw works and drive skids when rigging up or tearing down.

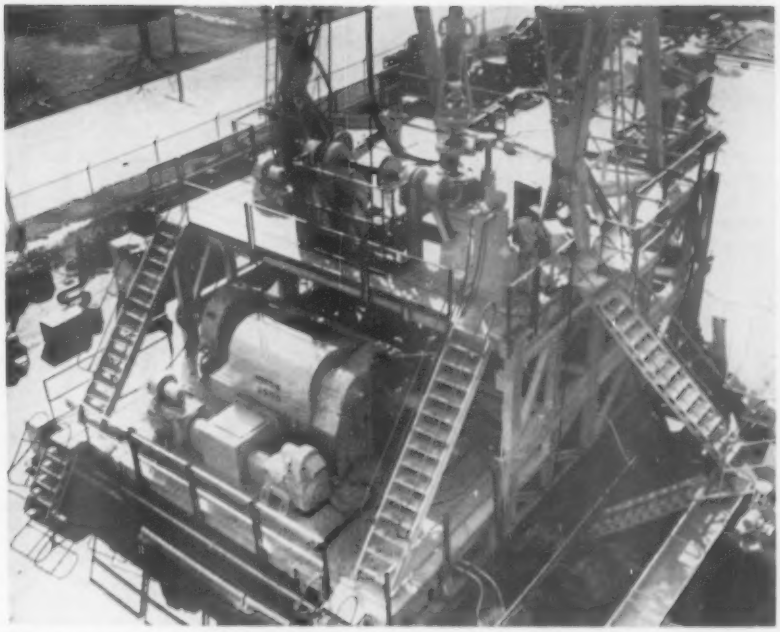
Catworks-rotary unit . . . The catworks and rotary-drive unit shown in Fig. 10 is custom built for Rig 15. Both catheads are air-operated Fosters. Although the unit carries the same 625-hp. motor as the other equipment, the control for it has a limited-torque position. Thus the driller can limit the input to 300 hp. or 2,800 ft.-lb. torque. This control works by regulating the excitation of the generator driving this motor.

Driller's control on floor . . . All operations on Rig 15 are under the control of the driller from his panel shown in Fig. 9. He can stop or start any motor on the pumps, draw works, and catworks; he can even control the motors on the cooling-air blowers. In an emergency, the driller can shut down all electrical power and leave the engines running. In extreme cases, he can shut down the rig completely—engines as well as motors.

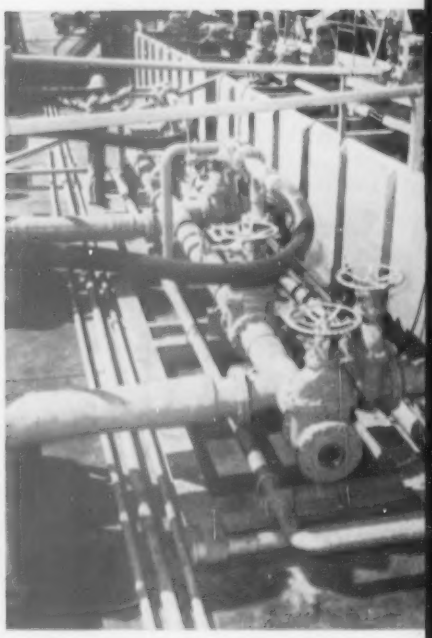
This floor panel also has a position-selector switch which assigns the four generators to the motors being used at any given moment. There are seven positions on this switch for the different combinations of motors to which the generators could be applied. With this selector, operation can go on if any one generator or one engine (i.e., two generators) goes down; there will still be enough power to operate a pump and turn the rotary or to drive the draw works and turn the rotary.

On the driller's panel, there is also a speed-control switch for the big engines, allowing him to run them at as low speed as the load requires. Both engines operate at the same speed.

For operating safety, the control



DRAW WORKS AND CATWORKS are on two separate levels. The truck-bed height of the draw works saves time in rigging up. The custom-built catworks carries a 625-hp. motor which allows the driller to control torque. At his control panel, the driller can start and stop any equipment on the rig. Fig. 9.



MUD TANKS all have two electric mixers. A flash mixer and a belt-type conveyor ease the job of fast mud mixing. Mud lines from tanks to pumps are unitized on skids. Fig. 10.

panel has lights to show overload on the big engines, low oil pressure, or high jacket-water temperature. There is also an alarm bell that operates with these warning lights; but since the driller cannot afford to lose all his power without warning, there is no automatic shutdown of the engines.

There is a mechanical linkage that connects the driller's brake lever with the brake on the draw works which is one level below the floor.

Insofar as possible, Sun has also unitized the remainder of the rig equipment.

Derrick and substructure . . . The new rig carries a 143-ft. Ideco Full-View mast, rates at 750,000-lb. hook load. This guyless mast is designed to withstand winds up to 100 m.p.h., with all pipe racked. The crown has seven 50-in. sheaves and the 400-ton traveling block has six 50-in. sheaves so that 12 lines could be strung.

The 16-ft. substructure was fabricated to Sun's specifications and consists essentially of four separate units. One is stacked atop another on either side of the well centerline, as Fig. 9 shows; and crossbrackets join them together after they are spotted on location. The lower units on either side are longer than the upper ones so that they make a truck-bed height step on which to place the draw works and draw-works-drive unit.

Sun has also put support plates at the four corners on top of the substructure in order that a standard derrick could be mounted on this same substructure. There are a few of the marshy Gulf Coast locations where there is not enough room to lay down a mast. To drill with a standard derrick on this substructure would require a move of only 7 in. of the well centerline. For such a case, Sun has made provisions in the rotary drive so that a modified shaft can be put in with a minimum of time and cost.

To speed up moving, Sun is also putting the drilling-line spool into the substructure. At the same spot on the opposite side will be a spool for storing the flexible conductors that carry electricity to the motors.

Mud tanks . . . The new rig has three steel mud tanks. Shown in Fig. 10 they are 5½ ft. high by 7½ ft. wide by 30 ft. long and a dual Rhumba shale shaker is mounted atop the one closest to the flow line. Also built onto the tanks are six Lightnin mixers and a Lightnin flash mixer. The rig is also equipped with a belt-type conveyor to make easier the job of putting dry mud into the tanks.

To save time in rigging up, Sun has unitized the mud lines from tanks to pumps onto the skid mount shown in Fig. 10. This unit was fabricated in the yard before being brought to the first location. The yard work was done so closely that only one weld was necessary after the equipment was set on the well location.

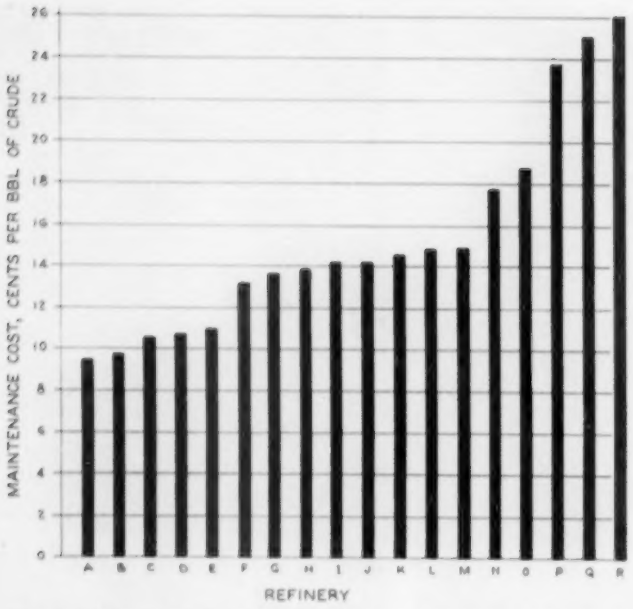
Operating fuel tanks . . . Diesel oil for the engines comes directly from a skid-mounted "day tank." This fabricated unit holds enough fuel for approximately 24 hours' operation and has a fuel dehydrator built into it. There is storage space for two kinds of crankcase oil, for solvent, and for used oil. To help keep the diesel fuel and oil clean, Sun has built an electrically driven transfer pump into the unit. It will move diesel fuel into the storage space or transfer lube oil directly to the engines.

Miscellaneous . . . Besides all the major items of equipment already mentioned, Rig 15 has several other skid-mounted packages. Two of them are the crew-change house and the dog house. Another is the Hydril accumulator for operating the blowout preventers; this is fitted with a 3-hp., three-phase a.c. motor. The pipe racks are of the portable type.

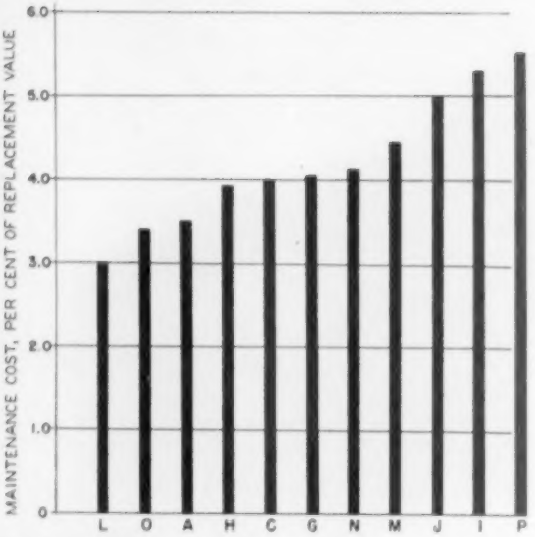
To prevent damage to the flexible power conductors, Sun has made protectors out of used 8-in. pipe. The pipe is split lengthwise and the cables are dropped into the slip. These protectors are put in place where the conductors pass through work areas.

Acknowledgment

Credit is due E. A. Goolsbee, W. E. Withers, and H. R. Huey of Sun Oil Co., Beaumont, for their assistance in the preparation of this article.



TOTAL DIRECT MAINTENANCE COST for a number of refineries in cents per barrel of crude throughput. Fig. 1.



TOTAL DIRECT MAINTENANCE COST in terms of percentage of refinery replacement value. Fig. 2.

You need dependable cost yardsticks to

Keep Those Maintenance Costs in Line

Here are some tips on how to develop them in the refinery

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by E. S. Bale, E. L. Mast, and R. E. Webster

AMONG the several methods of comparing maintenance cost, we have found most useful a method using ratios of current cost to capital investment in terms of current dollars.

Differences in level operation, type of process, soundness of design, organization and skill of the mechanical and operating functions—all result in variation of these maintenance ratios.

For several refineries studied, total direct cost ratios ranged from 3 to 5½ per cent. Individual process installations varied between 2 and 7 per cent, apparently depending upon severity of basic process involved.

These data show there is less difference between plants on major processing equipment than on "other facilities" which represent about one-half of the usual plant investment.

Studies of methods of measuring maintenance result were not so conclusive. Skilled observation, engineering inspection, safety performance, failure-rate analysis, and other known approaches deal mainly with specific points of maintenance result.

Analysis of failures within our refineries shows that they occur in a pattern. The shape of this pattern might help distinguish good from poor or erratic maintenance performance.

Maintenance vs. production . . . Maintenance is often related to production in terms of cents per barrel of crude. This number is easy to obtain for most operations. The values are simple numbers in the order of 10 to 25 cents, hence are easy to remember and compare.

Fig. 1 shows some data which we have collected recently on direct maintenance cost expressed in terms of cents per barrel of crude for some complete refineries.

Notice the wide variation which ap-

Authors are with Standard Oil Co. (Ohio), Cleveland. Paper presented at A.P.I. Refining Division meeting, Montreal, May 14-17, under the original title, "Development of Maintenance-Cost Yardsticks."

pears here. The higher values are almost three times the lower. These plants are fairly similar; all are complete gasoline refineries. Purchasing value of the dollar is not a variable here since these calculations are all for the same period. There is no correlation with size of plant.

This is not a difference in maintenance standard, since some of the better maintained plants may be found at opposite ends of the scale. Neither can location, weather, labor rate, nor age be used to explain these differences.

Maintenance in total dollars . . . Difficulties in arriving at a maintenance ratio or index have caused many people to drop the idea of making maintenance comparisons with other operations, and to concentrate on reducing the dollar amount of their own maintenance expenses.

This approach is certainly useful in controlling the maintenance of a specific plant. However, it does not provide any method for distinguishing between historically good experience and situations where maintenance costs have been high from the beginning.

Counting equipment . . . Because of the difficulties mentioned previously, we have been seeking some better basis for examining our maintenance costs. Two years ago some of our people reported on an analysis of maintenance manpower at two similar Sohio refineries which had widely different maintenance costs.

Our Lima refinery mechanical superintendent, M. A. Pappas,[2] showed that while process results were similar, the number of pieces of equipment installed in one plant was larger than in the other, and the maintenance in that plant was proportionately greater.

This is a logical observation. To a considerable extent, maintenance is a replacement of parts—and the more parts, the more replacement. Other maintenance functions, such as cleaning, inspection, etc., are also directly related to number of parts.

This approach is quite sound, but it may be difficult to supply, particularly in general management reviews. Certainly, the size of a part makes some difference in maintenance cost. Furthermore, it is difficult to add up valves and pumps and structural steel into total units of maintenance.

Maintenance Ratio to Investment

In January 1954, R. M. Cziner,[3] of Aries & Associates, wrote about investment as a maintenance base, mentioning annual maintenance ratios of 2 to 10 per cent on investment for various classes of equipment.

F. C. King, Jr.,[1] of General Petroleum Corp., used the same basis for comparing maintenance labor, and added a corrective feature for changes in building costs to take out the variable of inflation.

The thinking expressed in these earlier papers appeared to support the following premises:

1. The largest factor in determining maintenance expense is the amount of facilities installed.

2. Investment cost is a good measure of facilities installed, if corrected for inflation in labor and material unit costs.

To these premises we have added a third:

3. Total direct maintenance cost is more significant than just the labor component within it.

In arriving at the third premise, we observed that the use of contractor maintenance forces and the fabrication of repair parts within the refinery are two practices which varied greatly from plant to plant. These are presumably decided on the basis of local conditions.

They materially affect the direct labor component of maintenance, the first downward, the second upward. The real objective of these practices is to minimize total cost of maintenance, and we have directed our attention to the latter.

There are many other variables which affect maintenance beside investment. And some investment obviously affects maintenance inversely. One example is alloy pipe in place of carbon-steel pipe; another — useful built-in mechanical handling facilities. These installations raise investment but reduce maintenance.

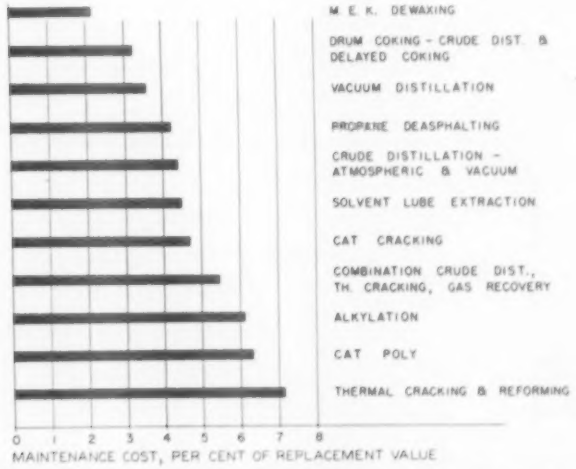
Correcting of inflation . . . This requires correction of original investment and maintenance to the same kind of dollars, eliminating the variable of labor and material unit costs. We have found it convenient to correct the investment cost to current dollars although the same effect could be achieved with constant investment by correcting the maintenance cost inversely.

In our own calculations we have used an index which we developed in relation to our own geographic locations. We have found that it corresponds very closely to the construction-cost index of W. L. Nelson,[4,5] published in 1949 and kept up to date in The Oil and Gas Journal. We have called this corrected capital cost "replacement cost," always expressed in current dollars.

Maintenance Ratios for Refineries

Wherever we have had enough data, we have calculated the ratio of current maintenance expense to replacement cost for the refineries used in Fig. 1. These ratios are shown in Fig. 2.

Note the reduced range among the various plants shown. Compared to a three-to-one range in the cents per bar-


M. E. K. DEWAXING
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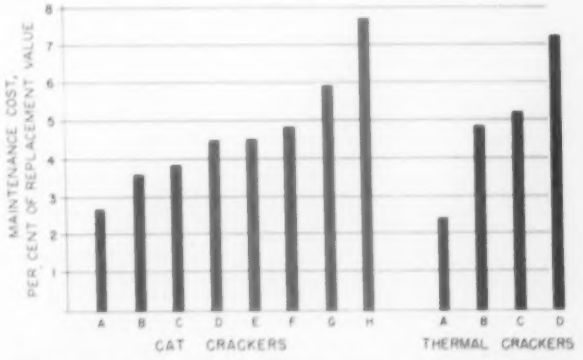
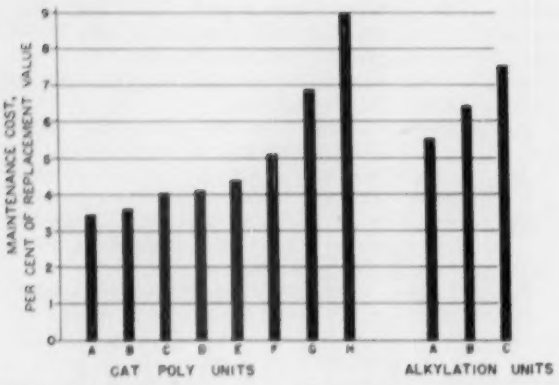
VACUUM DISTILLATION
PROPANE DEASPHALTING
CRUDE DISTILLATION - ATMOSPHERIC & VACUUM
SOLVENT LUBE EXTRACTION
CAT CRACKING
COMBINATION CRUDE DIST., TH. CRACKING, GAS RECOVERY
ALKYLATION
CAT POLY
THERMAL CRACKING & REFORMING
0 1 2 3 4 5 6 7 8
MAINTENANCE COST, PER CENT OF REPLACEMENT VALUE

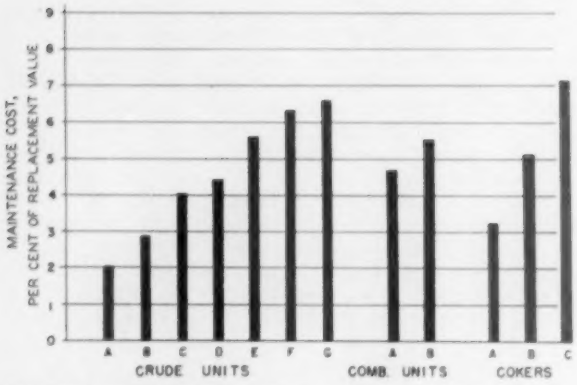
MAINTENANCE COST for major units in Sohio refinery. These are life averages. Fig. 3.



MAINTENANCE COST on individual units at Sohio and other refineries. Fig. 4.



COST OF MAINTENANCE on cat, poly, and alkylation units. Fig. 5.



COST OF MAINTENANCE on crude, combination, and coking units. Fig. 6.

rel illustration, the range among these data is less than two to one.

For eight of the refineries tabulated in Figs. 1 and 2, we had enough data to split out major gasoline-producing units from other refinery facilities. This split is summarized in Table 1.

The major gasoline-refining units involved slightly less than half of the plant investment, and required less than half the plant maintenance. The maintenance ratio for "other facilities," on the average, is only slightly lower than the ratio for major refining units.

Table 2 presents, plant by plant, the same data summarized in Table 1. Except for one plant, major units as a group do not differ too greatly from plant to plant, but "other facilities" show greater variation.

From these data one might surmise that maintenance expenditure on "other facilities" may be the major variable in total refinery-maintenance costs.

How do the various producing units compare on maintenance ratios? We have drawn upon Sohio data alone for the values shown in Fig. 3. These data are lifetime averages for each process.

There is quite a difference among the various processes. In general, one might conclude that the processes involving higher temperature, higher pressure, or corrosive material will have higher maintenance ratios. This is quite reasonable, although the magnitude might not have been predicted.

Cracking units . . . Fig. 4 illustrates maintenance costs on a number of cracking units. These are data for single years in most cases.

Of the eight cat cracking units shown, the two on the right are abnormal. The highest, a new small unit, experienced an operating upset which seriously damaged the unit during the year reported. The other is an older unit which has since been replaced.

Among the thermal-cracking units there is quite a substantial variation.

TABLE 1—DIVISION OF EQUIPMENT INTO MAJOR GASOLINE REFINING AND "OTHER"—EIGHT-REFINERY AVERAGE

	Major gasoline refining equipment	Other equipment	Total equipment
Per cent of total maintenance cost	47	53	100
Per cent of total refinery replacement value	45	55	100
Maintenance cost, per cent of replacement value	4.1	3.7	3.9

TABLE 2—DIVISION OF EQUIPMENT INTO MAJOR GASOLINE REFINING AND "OTHER"—INDIVIDUAL REFINERIES

	Major gasoline refining equipment		Other equipment		Total equipment—
Refinery	Per cent of total equipment	Maint. cost, per cent of replacement value	Per cent of total equipment	Maint. cost, per cent of replacement value	Maint. cost, per cent of replacement value
A	38	3.71	62	2.54	2.98
B	36	4.91	64	2.59	3.42
C	66	3.48	34	4.78	3.93
D	55	4.20	45	3.80	4.02
E	45	3.38	55	4.57	4.03
F	40	6.07	60	2.77	4.10
G	51	4.55	49	5.39	4.96
H	46	4.06	54	6.28	5.27

The average ratio, however, is not far different from the catalytic cracking unit ratio.

The same type of information is charted for cat poly and alkylation units in Fig. 5. With the exception of two poly units, where acid carryover has been a major problem, these experiences have been uniform within their respective groups.

We also have some significant data on crude-processing facilities. These are exhibited in Fig. 6.

There is more variation than we expected in regular crude-distillation equipment. It may be significant that the three highest units are all older ones.

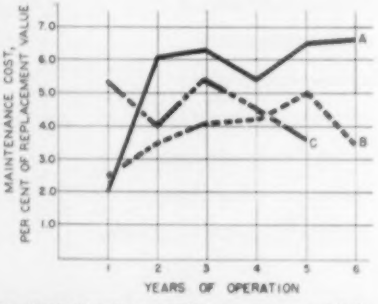
The two combination units line up fairly well with their crude and cracking components.

The three coking units are quite variable. Perhaps the one on the right should be discounted because of a questionable replacement value.

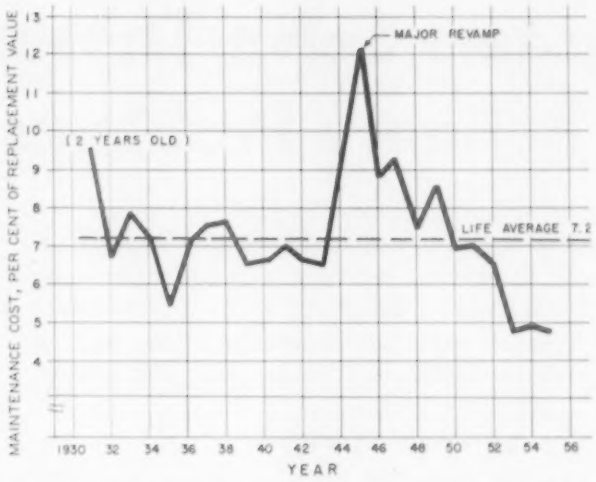
The apparent effect of age on maintenance ratios suggests another approach to their use. We have plotted the life histories of some units in terms of maintenance ratios. In these plots, as in the life-average data presented earlier, the maintenance cost for each year is divided by the replacement value for that same year.

Cost vs. age . . . Fig. 7 shows life-history data for three catalytic cracking units. "A" is an older unit which was rebuilt after the 6-year period shown. "B" and "C" are different catalytic cracking processes currently operating on similar feed stocks.

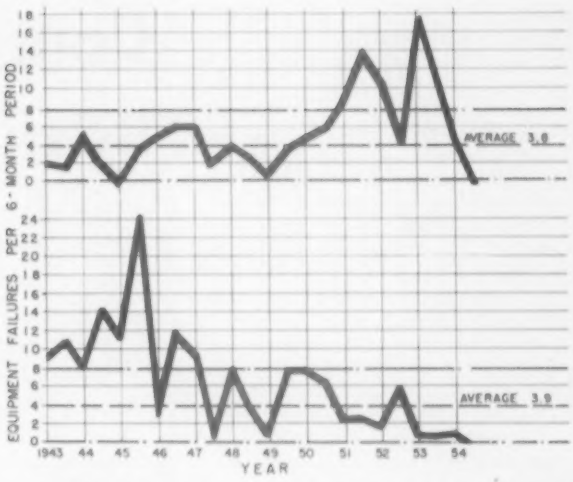
Fig. 8 presents the 25-year life his-



MAINTENANCE COST on three catalytic cracking units of different types including gas plants. Fig. 7.



COST OF MAINTENANCE on four thermal cracking and reforming coils. Fig. 8.



EQUIPMENT FAILURE on major units in two refineries. Fig. 9.

tory of four thermal-cracking and reforming units. (Data from the first 2 or 3 years of operation are missing.)

Maintenance was fairly normal until 1945. During World War II, drastic cracking for codimer feed and deferred maintenance led to major repair work.

As these units approach the end of their useful life, maintenance is being held to the minimum required for safety. Note how the curve highlights these effects.

Table 3 shows data on specific pieces of equipment from two of our refineries. Note that pumps have a relatively high average-maintenance ratio of 7.0, and a wide range of individual results. Cost ratios for motors averaged much lower, 1.2 per cent, but still exhibited a fairly wide range.

Classifications such as these cover a wide range of services. By comparing maintenance ratios for equipment in similar service, good and bad units can be readily identified.

Maintenance ratios based upon capital-replacement values bring some semblance of order to maintenance comparisons. While such comparisons are not exact, they may help to find areas of possible improvement and point the way for engineering and administrative attention.

Measuring Maintenance Results

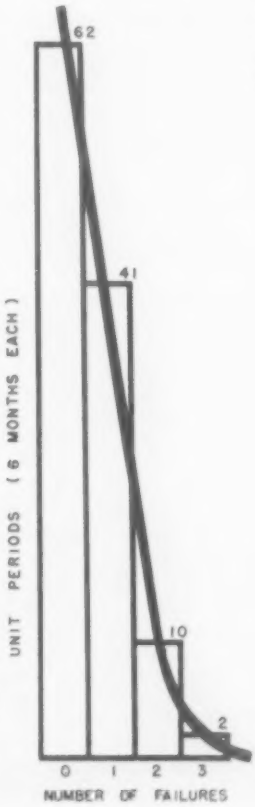
The observations and records of engineering inspection provide a quantitative appraisal of maintenance results. Inspection can exercise control on undermaintenance, but does not measure overmaintenance as readily.

Service factors are often used as a measure of maintenance effectiveness. These factors are calculated in several different ways, and are influenced greatly by the manner in which the units are operated. This control has a tendency to motivate operators to extend runs rather than maximize production. For this reason, it may prove disadvantageous to use it as a measure of performance.

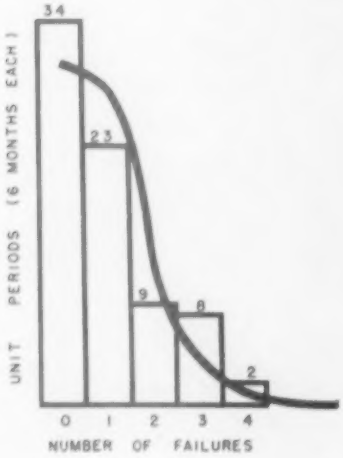
Failure-rate analysis . . . Serious maintenance weaknesses will show up in a bad accident record, but even plants with good maintenance have some failures. We are attempting to study such

TABLE 3
Maintenance Cost on Two Classes of Equipment, Each Class Samples from One Refinery

	Per cent of replacement value	
	Average	Range
Pumps	7.0	1-18
Electric motors (1-100 hp.)	1.2	0.1-5.1



FREQUENCY DISTRIBUTION of failures on major units at a refinery over a 10-year period. Average number of failures per unit per 6 months = 0.58. Fig. 10.



FREQUENCY DISTRIBUTION of failures on major units plotted from upper curve of Fig. 9. Average number of failures per unit per 6 months = 0.96. Fig. 11.

failure records statistically without regard for the specific causes.

Fig. 9 presents a chronological plot of equipment failures in two refineries over a considerable period of time. The failures reported included such things as furnace-tube splits, exchanger difficulties, blown-out pump packing, seized bearings, line breaks, etc.

About 80 per cent of these failures resulted in unit shutdowns, at least temporarily. One point appears on the chart for each 6-month period over the past 10 to 12 years.

Each of these plants experienced a long period of relatively low failure. But both plants went through a period of significantly higher failure rates.

Incidentally, the average failure data for the better periods on these charts compare quite closely to similar experiences in other plants with low failure rates.

This same type of information is charted in Figs. 10 and 11. These are frequency-distribution charts, in which the number of unit time periods having a given failure rate is plotted against the number of failures per period.

Fig. 10 presents combined data from six major units in another refinery.

The shape of the chart looked very much like a Poisson distribution, and a calculated Poisson curve was superimposed on the chart for comparison.

This suggests some interesting possibilities. Failure-frequency charts might help distinguish good over-all refinery performance from erratic or generally poor performance.

Another frequency-distribution chart is presented in Fig. 11. This is the same data as plotted in the upper curve in Fig. 9. The performance in this plant is not nearly as consistent with the Poisson distribution as Fig. 10. The chronological plot in Fig. 9 included one 3-year period of higher failure frequency.

These data, while dealing with mechanical failures, reflect the combined activities of the operating and the mechanical forces. The skill and effectiveness of the operating personnel may be a greater factor in maintenance cost than that of the maintenance people.

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Computers Solve Those Basic Refinery Problems

Use of a high-speed computer greatly increases the amount of computation which it is practical to perform in the refinery. It puts the refinery in much better position to meet unexpected situations such as equipment breakdown. It liberates the process engineer from tedious calculations and so enables him to be more productive.

by Jack Sherman

IN a moderate-size or large petroleum refinery there generally exists some freedom in determining the compositions of the various products and in choosing values of the controllable process variables for a given set of product specifications and given crude avails. Moreover, the product specifications, crude-oil supply, and refinery operations do not remain constant for long.

The basic computing problem in petroleum refining is, therefore, a determination of the most suitable operating schedule for a given situation.

Recently, this type of computation has been performed in The Texas Co. on a large-scale electronic digital computer.

Computing machines . . . Generally speaking, computers can be classified according to two types: analog and digital.

An electric analog computer for solving the linear simultaneous equations arising in mass spectrometer analyses is rather widely used in petroleum refineries.

A digital computer operates by a discrete counting process. The general-purpose machines commercially available at present range in size from small manually operated desk calculators to large electronic systems capable of performing thousands of numerical operations per second.

These electronic computers have other essential characteristics in addition to their high speed of computation. One of these is their ability to make logical decisions, such as an alteration of the sequence of arithmetic steps at some intermediate stage of the problem, dependent upon some intermediate result.

Another characteristic is the storage within the machine of all the data and arithmetic instructions at the outset with subsequent high-speed random access to any item of data or to any instruction. These properties of large electronic computers provide the flexibility needed to handle the trial-and-error type of computation which is characteristic of refinery processing studies.

Author is with The Texas Co., Houston.

Paper presented at A.P.I. Division of Refining meeting, Montreal, May 14-17, under the original title, "The Use of Computers in Petroleum Refining Problems."

REFINING

Refinery Processing Studies

The primary objective of carrying out numerical computations relating to processing studies for a given refinery is to determine optimum values of controllable process variables which will result in producing the finished products in the desired amounts, and in meeting the specifications set up for these products.

Thus, if a refinery is operating so as to produce motor gasoline and other products and it is desired to increase the octane-number specification of the gasoline by a small amount, it may be possible to do so by changing the schedule of operations. However, as the desired octane-number increase becomes larger and larger, there will be some point at which the refinery will be unable to meet the desired specifications with the equipment at hand.

In this case, it will be necessary to introduce an additional process such as catalytic reforming. During the past few years the petroleum industry has been investing many millions of dollars for this purpose.

Defining the problem . . . Consider a refinery operating with given crude avails and producing gasoline and other finished products conforming to given specifications. In general, the specifications determine neither the compositions of the products nor the values of

the process variables uniquely. The specifications are frequently maximum or minimum specifications rather than unique values.

At the outset the parameters in the refinery system are the values of the process variables, such as feed rates to the various units, operating temperatures, etc., and the compositions of various intermediate streams of the finished products. From the mathematical standpoint one has a set of simultaneous inequalities involving the process variables and compositions, in terms of the specifications of the finished products.

Computationally, it is desired to determine the permissible ranges of the parameters which satisfy the set of simultaneous inequalities. When these computations are carried out by a refinery engineer by means of a desk calculator, a complete mathematical formulation of the problem is omitted.

The engineer frequently makes "decisions" during the course of the computations, based upon past experience, in order to arrive at a satisfactory set of process variables and product compositions within a reasonable period of time. However, it is rarely practical, when a desk calculator is used, to explore the complete permissible range of parameters so that a given set of values can be determined within this range which optimizes profit or achieves some other desired condition.

Crude selection . . . About 2 years ago The Texas Co. decided to undertake the task of carrying out some refinery processing studies by means of a large electronic computer which was available at that time on an hourly rental basis. The company's Eagle Point Works, at Westville, N. J., was chosen as the refinery for this study because of its intermediate size and its proximity to New York City where the computer was located. The specific problem involved an evaluation of several possible crude oils in order to provide a basis for decision as to what crudes should be made available to this refinery for future processing.

It is evident that the first problem was that of obtaining a complete mathematical simulation of the Eagle Point Works. This involved converting the numerous graphical correlation to equation form. These correlations are of two general types, one of which relates to pertinent properties (A.P.I. gravity, 50 per cent point, viscosity, etc.) of the effluent streams in a given unit process to the properties of the feed and operating variables of the process.

The second type of correlation involves the blending of primary and intermediate streams and the relationships between the properties of a blend and those of the components. In both cases these correlations are based upon plant and laboratory data and are specific to each refinery.

In some cases it turns out to be quite difficult to obtain an equation which agrees with a graphical correlation sufficiently well over the complete ranges of the variables. However, in these cases it is usually satisfactory to approximate the entire curve by two or more straight-line segments over smaller intervals. The electronic computer can be programed to select the proper interval for a given value of the independent variable, and then select the corresponding linear equation with which to compute the dependent variable.

When a suitable mathematical model of the refinery had been obtained, the next problem was to perform the numerical and mathematical analyses of the system. When the equations are nonlinear, as was true in the case in question, no general mathematical method is known for the direct solution of a system of simultaneous equations and inequalities.

Trial-and-error procedures are required, and these must be formulated in complete detail. This was followed by a detailed description of the flow of the computations leading to the desired results. The flow involves all the decisions as to the exact sequence in which the computations are to be carried out, the information to be printed, and the like.

The next step is to translate the computational flow into a series of instructions which can be introduced into the machine and carried out at electonic speed. This coding invariably contains errors and so must be checked out and corrected insofar as possible before real production can begin.

In a complex where many alternative paths of computation can occur during the course of the problem, it can become entirely impractical to verify the correctness of every possible flow at the outset. In a case of this kind, the only practical procedure is to start using the program and to eliminate errors as they are discovered in use. When the program has been in use on a large variety of problems, the reliability increases and approaches certainty.

The time required, in this instance, to set up the mathematical model, perform the numerical analysis and code and check out the computational machine program was approximately 8 man-months. Thereafter, a complete material balance under a given set of conditions could be obtained in approximately 15 minutes, as compared with a week or more for the hand calculation.

Advantages . . . This difference in time has several important consequences. It liberates the process engineer from tedious desk computations, and so enables him to be more productive, with consequent increase in interest and morale. Moreover, with the present critical shortage of technically trained people available to industry, the use of a high-speed computer is one of the few ways available to a company to increase effectively its technical productivity with its present technical staff.

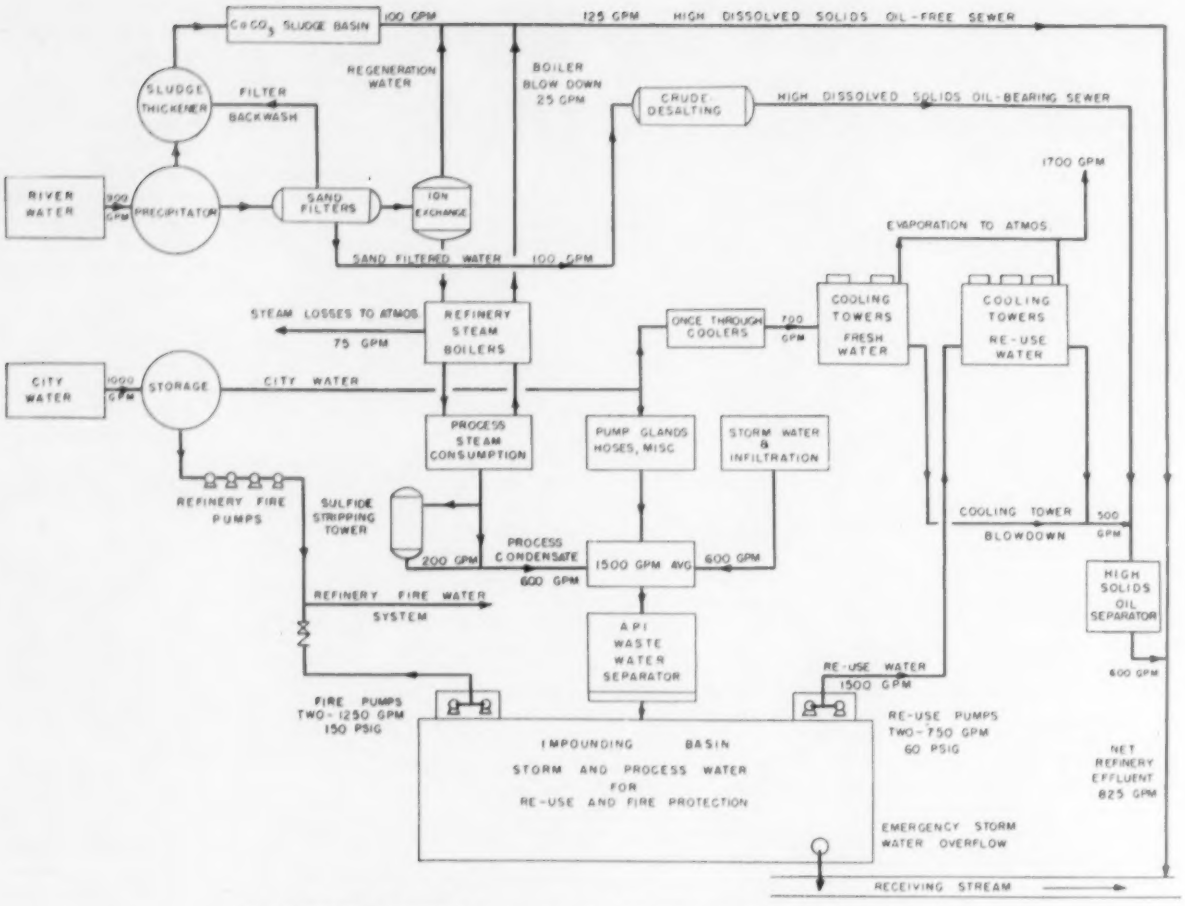
Another important advantage of using a high-speed computer for processing studies is that it puts the refinery in a much better position to meet unexpected breakdown of a piece of equipment or the sudden necessity to use a different source of crude oil.

The first set of material balances obtained for the Eagle Point Works of The Texas Co. seemed to be at variance with what the process engineer expected intuitively. However, a detailed study of the results showed them to be correct, and that intuition was not reliable in qualitatively predicting the effect of numerous variables changing simultaneously. The results suggested a new series of balances to be computed, the results of which proved to be informative.

Thus, by alternately computing and studying the results, the engineer was able to increase his knowledge of the operating characteristics of the refinery in a matter of days—information which could not have been obtained in several months of hand computation. This is perhaps the most important consequence of electronic machine computing.

New product studies . . . In addition to facilitating the study of the operation of an existing refinery, the same kind of computations have been made in determining the feasibility of making new products, as well as the economic advantage of introducing additional equipment into a refinery and of building new refineries. Even more broadly, it becomes practical for a company such as The Texas Co., which operates several refineries, to consider its simultaneous operation with respect to optimum crude-oil allocation and optimum over-all operation.

The computations can be extended to include considerations of distribution costs of crude oils and finished products, of production costs of crude oils, of statistical analysis of sales to forecast demand, and the like. There is no doubt that the ultimate result of using high-speed electronic computers to attack this general problem will be to achieve a significant increase in refinery operating efficiency.



REUSE WATER SYSTEM employed by Sun Oil Co. in its Toledo refinery. Fig. 1.

How Sun Oil Licked Its Water Problem

Pollution control and conservation were achieved at Toledo by biological oxidation and reuse of refinery waste water

by Harold F. Elkin

THE water-supply and waste-disposal system at the Sun Oil Co. refinery, Toledo, provides for:

- Comprehensive pollution control of all plant waste waters.
- Reclamation of spent waters for reuse within the refinery with minimum pretreatment.
- A virtually unlimited water supply for emergency fire protection.

Waste treatment is accomplished by selective segregation of waste waters at their source, with no treatment other than removal of oil and settleable solids in conventional A.P.I. separators, followed by 5-to-8 day retention in an impounding basin for equalizing and initial biological treatment.

The first step in the program was installation of a flue-gas stripping tower for removal of sulfides in the process waters to be reused. The second phase of the project consisted of segregating low-alkalinity process waste waters together with storm water from ground runoff. Approximately 1,500 g.p.m. of these waters is available for reuse as cooling-tower makeup following retention in the separators and impounding basin.

High-alkalinity waste waters, not suitable for reuse, are collected in a separate system and discharged after oil removal. The impounding basin also serves as a reservoir for emergency storage for fire-fighting water delivered by two high-pressure 1,250-g.p.m. diesel-driven, vertical, centrifugal fire pumps.

This supply is virtually inexhaustible, inasmuch as fire water used in the plant can return to the impounding basin via the storm sewer system.

Biological oxidation of waste waters during reuse in cooling tower systems

has consistently reduced phenols in excess of 99 per cent, and chemical oxygen demand has been substantially lowered. There have been no adverse effects on heat-transfer efficiency or on corrosion rates in the tubular cooling equipment.

The entire program represents a new approach to the multiple problems of refinery pollution abatement, water supply, and fire protection.

In the 1940's, Sun engineers were confronted with the manifold problem of expansion in the Toledo plant which has grown to be the largest refinery in Ohio. Crude charging capacity now totals 95,000 bbl. per day. Process facilities include combination crude and catalytic cracking, thermal cracking, Platforming, polymerization, furfural, and gas-stabilization units.

Various alternatives were considered to meet the additional water demand, including installation of a supplemental river-water pipeline with further raw-water precipitation equipment and the purchase of increased quantities of treated city water. While additional water supply would satisfy immediate requirements, the increased flow rate would result in larger quantities of effluent water and pollution loading.

After considerable study and discussion with refinery personnel, the decision was made to reuse existing plant waste waters rather than to increase the supply from outside sources. Reuse not only provides the necessary additional water supply source, but has the added advantages of the economic value of the water returned to process, pollution-abatement benefits, and reduction of net effluent leaving refinery.

Cooling towers selected . . . Cooling towers were selected as the equipment to receive the reuse waters, primarily because of their high volume demand and their ability to serve as treatment units for biological oxidation of pollutants in the waste waters. It was recognized that effective biological oxidation in conventional cooling towers would obviate the need for extensive waste-treatment equipment for final effluent improvement.

Cooling towers also had the advantage of requiring relatively low-quality makeup water, compared with other process equipment demands, thereby eliminating costly pretreatment of reuse water. Finally, the towers would reduce the over-all quantity of plant discharge by evaporation during recirculation.

Sun had gained experience over several years with chemical and bacteriological waste-treatment procedures and, in 1953, installed a modified bacterial oxidation system at its Canadian refinery in Sarnia, Ont.[1]

Segregation and Reuse

Reuse was accomplished by selective segregation of waste waters at the source, with no pretreatment other than gravity separation for removal of oil and separable solids, followed by retention in an impounding basin for further equalizing and initial biological oxidation.

A flow diagram showing quantities and sources of water in the collection and reuse system when in full operation is shown in Fig. 1.

The first step in the over-all program was the installation of a flue-gas stripping tower for removal of sulfides in the process waste waters to be reused. Sulfides interfere with biological activity and cause corrosion in the cooling systems. Approximately 200 g.p.m. of process waters is collected in a sulfide-collecting sewer and are charged to a 5-ft.-diameter by 31-ft. vertical stripper packed with raschig rings.

Up to 120,000 std. cu. ft. per hour of 950° F. flue gas from an adjacent catalytic regenerator is passed through the stripper for sulfide removal. Temperature is maintained at approximately 190° F. in the tower. Recently, sulfuric acid has been added for pH adjustment and greater efficiency.

Second phase . . . This phase of the project consisted of completely segregating plant waste waters as to type and characteristics. Low alkalinity process waste waters from such operations as steam stripping, once-through cooling on pump bearings and miscellaneous wash waters, together with contaminated storm water from ground runoff, were permitted to flow through the existing refinery drainage system—designated as the low-solids contaminated sewer system—to the A.P.I. separator for primary removal of oil and settleable solids.

An impounding basin, 1,200 ft. long by 200 ft. wide and 10 ft. deep, with a maximum liquid capacity of 8,000,000 gal., was constructed at the outlet of the A.P.I. separator to provide storage, equalizing, removal of residual free oil and settleable solids, and preliminary biological oxidation.

A minimum level of 1,500,000 gal. of waste water is reserved in the impounding basin for not less than 10 hours of emergency fire-water supply. The fire-water supply is virtually inexhaustible, since all water used in the plant can return to the impounding basin via the above-mentioned low solids contaminated storm and process sewer system.

Two 1,250-g.p.m. diesel-driven, vertical, centrifugal fire pumps were mounted at the basin to provide emergency protection and augment the 3,700-g.p.m. fire-pumping capacity already located within the refinery.

Oil-free waste waters, high in alkalinity and not suitable for reuse, including water plant ion exchange regeneration water and blowdown from steam boilers, are collected and sewered directly to the receiving stream.

Oil-bearing, high-alkalinity waste waters, including cooling-tower blowdown and crude desalting wash water, are segregated in a new sewer system and delivered to a new auxiliary A.P.I. high-solids separator for oil removal before discharge. The main quantity of refinery waste waters is collected in the low-alkalinity reuse sewer and impounding basin system.

Two 750-g.p.m. vertical, centrifugal water reuse pumps were installed at the impounding basin to return substantially all low-alkalinity process and storm water to existing refinery cooling towers as makeup with no pretreatment beyond gravity separation and impounding for 4 to 6 days.

Initial operation . . . A 1-year period of initial operation of the reuse system has been completed and results have exceeded expectations. The collected low-alkalinity process and storm waters have proved satisfactory for cooling-tower makeup service. Phenol content in the reuse water has been reduced over 99 per cent during recirculation, beginning with the first day of operation, and chemical oxygen demand has been substantially lowered.

Table 1 presents a summary of maximum, minimum, and average water quality content in the cooling-tower makeup and blowdown water in reuse service. Phenol concentrations in the makeup water have varied from 8.4 to 70.0 p.p.m., while the tower circulating water phenol content seldom exceeds 0.10 p.p.m. Chemical oxygen demand has been markedly reduced, while sulfides and mercaptans in the makeup water have been reduced to essentially zero during recirculation.

THE AUTHOR

HAROLD F. ELKIN is sanitary engineer, engineering division of Sun Oil Co.'s manufacturing department, Philadelphia. He joined Sun in 1948, after receiving an M.S. degree in sanitary engineering from University of North Carolina. Elkin was the recipient of a predoctorate fellowship from the U. S. Public Health Service. He has authored several articles on industrial waste-disposal problems. This paper was presented at the A.P.I. division of refining, Montreal, May 14-17. Original title was "Biological Oxidation and Reuse of Refinery Waste Water for Pollution Control and Water Conservation."

Table 2 summarizes reuse water pollution reduction in the cooling tower, expressed in pounds per day. Calculated poundage loading to and from the tower is based on measured makeup and blowdown rates. Phenol content has been reduced from an average of 175 lb. per day to 0.22 lb. per day, representing 99.9 per cent removal. Oil content of the final refinery effluent has been lowered to approximately 1 bbl. per day.

Cooling Tower Operation

From 500 to 950 g.p.m. of reuse water has been pumped to an existing 18,000-g.p.m. forced-draft redwood cooling tower during the initial operation period. This tower provides cooling service for conventional tubular equipment in a catalytic cracking unit. No major modifications have been made to the tower or cooling equipment.

The presence of bacterial sludge was noted within several hours after injection of the phenolic-bearing waste water, although the system was not seeded with phenol-consuming organisms. The bacteria are probably naturally airborne and waterborne. Examination of bacterial sludge under the light and electron microscopes indicates the presence of a wide variety of biological life, including rod-shaped bacilli, circular cocci, protozoans, and traces of algae.

The cooling-tower environment is particularly suited to biological activity because of water temperatures of 90° to 100° F., extensive internal contact surfaces in the form of wood packing, recirculation of waste water for repeated contact and dilution, and the presence of excess oxygen drawn into the tower by mechanical draft fans.

Nutrients for normal bacterial metabolism, including nitrogen and phosphorous, occur in the cooling tower water in the form of ammonia from catalytic cracking process waters and in polyphosphate normally added to the cooling system for sequestering and corrosion inhibition.

No objectionable algae growths have been encountered in the cooling tower system during reuse, although the addition of small quantities of copper sulfate has been continued. It has been possible to eliminate the use of chlorine for biological slime control. It is believed that algae growths may be controlled by phenolics and phenol-consuming bacteria in the circulating system.

Normal water backwash has prevented objectionable accumulations of biological sludge in tubular equipment.

Small quantities of acid have been required to reduce alkalinity in the makeup water. Carbon dioxide, produced by decomposition of phenolic compounds and other organic materials, contributes to lower pH, thereby reducing theoretical acid requirements.

Effect on heat transfer . . . There have been no adverse effects on heat transfer efficiency of tubular cooling equipment with reuse water. A measured tubular heat-transfer rate of 50 B.t.u. per sq. ft. per hour per °F. is essentially the same as with previously used fresh water makeup.

Corrosion rates in steel tubular equipment with reuse water have remained at the same low levels as with formerly used city water. Measured corrosion rates in brass tubulars have increased somewhat with reuse water but have remained at similar low levels. Table 3 summarizes corrosion-rate data developed during initial operation.

Examination of wood specimens obtained from the 18-year-old cooling tower, following 4 months of reuse operation, disclosed no evidence of biological effects on the wood. A report by the Forest Products Laboratory of the U. S. Department of Agriculture indicated that the tower wood is in good condition.[2]

While the presence of some fungus growths was observed, there was little evidence of penetration or breakdown of wood fiber walls, and no evidence of the soft-rot type of deterioration that has been reported in some wood failures.

Conclusion

Following the satisfactory initial operation period described herein, the water reuse system is currently being extended to other cooling towers in the Toledo refinery, and pumping capacity will be increased to return all reusable water to the tower systems.

TABLE 3—CORROSION RATE DATA FOR TUBULAR EQUIPMENT

	Steel tubulars (i.p.y.)	Brass tubulars (i.p.y.)
Fresh water makeup*	0.0040	0.0020
Reuse water makeup*	0.0040	0.0040

*Copper sulfate and polyphosphate added to cooling-tower circulating system.

Acknowledgments

Process and project engineering design was by Sun Oil Co. The distribution system, mechanical equipment, pump house, and separator were installed by Catalytic Construction Co. and local subcontractors. The impounding basin was constructed by Jeffers, Inc.

References

1. H. F. Elkin, "Application of the Activated Sludge Process to Treatment of Refinery Effluent Waters." Paper presented at the thirty-eighth annual Texas Water and Sewage Works Association meeting, Industrial Session, College Station, Tex., March 9, 1956.
2. Private communication, U. S. Department of Agriculture, Forest Products Laboratory, Madison, Wis., January 1956.

TABLE 1—COOLING TOWER REUSE WATER QUALITY SUMMARY

	Cooling-tower makeup			Cooling-tower blowdown		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Flow rate (g.p.m.)	950	500		500	150	
pH	9.15	7.60	8.20	7.85	6.50	7.25
Alkalinity, $CaCO_3$* (p.p.m.)	224	88	158	124	56	83
Sulfates, $CaSO_4$ (p.p.m.)	410	58	299	645	212	464
Suspended solids (p.p.m.)	36	10	24	118	24	69
Dissolved solids (p.p.m.)	678	386	562	1,000	558	816
Phenols (p.p.m.)	70.0	8.4	23.8	1.20	0.004	0.091
Calculated oxygen demand (p.p.m.)	541	172	349	431	141	273
Sulfides (p.p.m.)	12	0	3	0	0	0
Mercaptans (p.p.m.)	4.6	0	1.3	0.9	0	0.1

*Sulfuric acid added to tower for alkalinity reduction.

TABLE 2—COOLING-TOWER REUSE WATER POLLUTION-REDUCTION SUMMARY

	Cooling-tower makeup			Cooling-tower blowdown			Per cent removal
	Maximum	Minimum	Average	Maximum	Minimum	Average	average
Phenols (lb. per day)	366	75	175	2.16	0.01	0.22	99.9
Calculated oxygen demand (lb. per day)	3,460	1,700	2,516	2,590	350	905	64.0
Sulfides (lb. per day)	72	0	13	0	0	0	100.0
Mercaptans (lb. per day)	28	0	8.5	5.4	0	0.8	90.5

Richfield goes all out to

Battle Catalytic Reformer Corrosion

. . . New unit will be protected against high-temperature sulfide attack

by B. W. Neumaier and C. M. Schillmoller

RICHFIELD OIL CORP. is making an all-out effort to avoid the very high corrosion rates and the scaling problems which are being caused by high-temperature sulfide attack in catalytic reforming and associated processes.

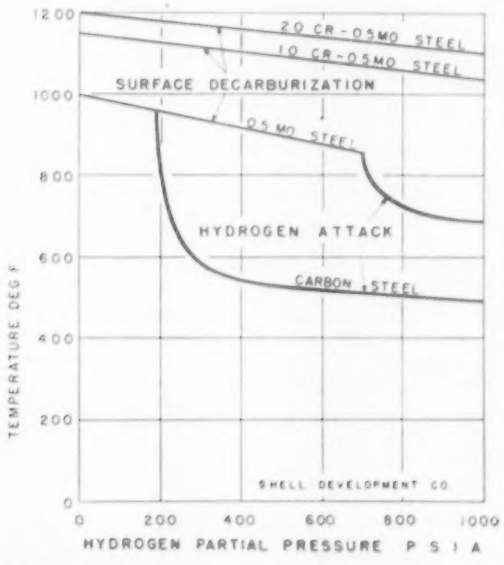
Anticipated maximum corrosion rates have been plotted for different hydrogen sulfide concentrations at temperatures which occur in the reformer and hydrodesulfurizer units. Metallurgical selections for various parts of the units are based on these graphs.

The detailed application of corrosion-prevention principles in the design stage of these units should drastically reduce corrosion troubles.

Nelson's graph . . . The effectiveness of carbide-stabilizing elements in steel has been evaluated by a survey covering a wide variety of commercial processes which use hydrogen at high temperatures and pressures. In a report on this, G. A. Nelson[1] presented a graph defining the safe operating limits for carbon and low-alloy steels.

Part of this graph is reproduced in Fig. 1, limited to the pressure range found in catalytic reforming and associated processes. These data have been used as a basis for the design of many high-pressure-high-temperature hydrogen processes and in no instance, where the requisite alloy content has been adhered to, has hydrogen damage been reported.

Authors are with Richfield Oil Corp., Wilmington, Calif. Paper presented at A.P.I. division of refining meeting, Montreal, May 14-17, under the original title, "How Richfield Plans to Combat High-Temperature Sulfide Corrosion in Its New Catalytic Reformer."



OPERATING LIMITS for carbon and alloy steels in contact with hydrogen. Fig. 1.

Hydrogen reactivity . . . When observing the curvature of the carbon-steel line in Fig. 1, it is of interest to note the quite sudden and very rapid decrease in resistance to corrosion at a hydrogen partial pressure of approximately 200 psi. Below this value a temperature as high as 950° to 1,000° F. is required for hydrogen attack to occur, which indicates that hydrogen is only moderately reactive in this range.

Above 200 psi. partial pressure a temperature of 500° to 600° F. is sufficient to cause damage; thus, in this range, hydrogen is very reactive. This reactivity does not seem to increase much when partial pressures are raised from 400 to 10,000 psi.

Environment differences . . . The main factors which distinguish high-temperature hydrogen-sulfide attack in thermal and catalytic cracking units from hydrogen-sulfide attack in catalytic reforming equipment are the high pressure and the presence of hydrogen. The system pressure, of course, increases the partial pressure of hydrogen sulfide, which makes it more reactive.

The dissociated hydrogen is reactive and can diffuse through the steel. It will combine with the sulfide in the iron sulfide scale, reduce scale, and create a scale with a porous structure—an open lattice—through which the iron and sulfur ions can maintain high diffusion rates. In addition, hydrogen suppresses the formation of coke deposits which can act as effective corrosion barriers.

Mechanism differences . . . At near-atmospheric pressures, such as occur in thermal and catalytic cracking processes, the stability of steel against hydrogen sulfide increases with increasing chromium content.

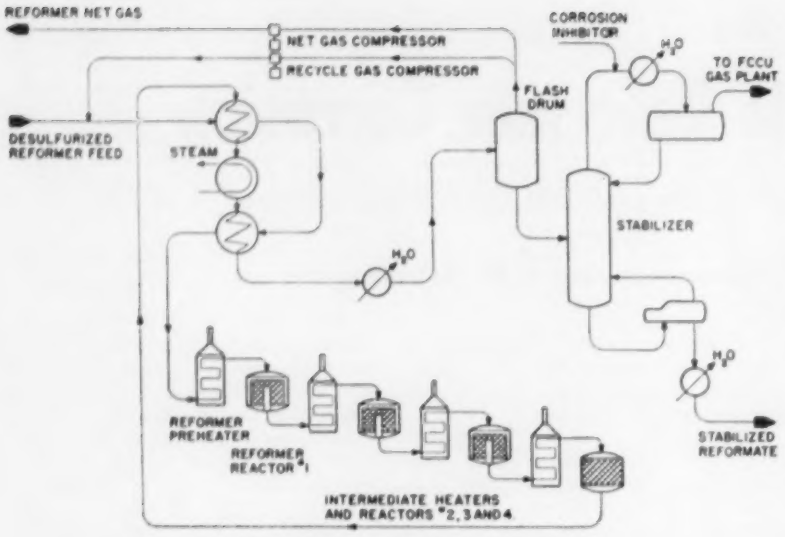
Dittrich's work[3] showed that under pressure at elevated temperature the low-chrome steels, with up to 10 per cent chromium, were more vigorously attacked than carbon steel.

High corrosion rates . . . These are the reasons for the high corrosion rates experienced in catalytic reforming equipment. A definite lack in scale stability is found in many applications and becomes worse with an increase in temperature. Corrosion rates as high as 0.30 in. per year have occurred on low-chrome steels in reformer equipment operating at 950° F., with 0.8 per cent by volume of hydrogen sulfide present.

Corrosion rates diminish with scale thickness. Often several layers of scale can be noted, the number of which is said to correspond to interruptions in operations. Each layer corresponds to a major change in temperature or in hydrogen-sulfide concentration. The outer layer is brittle and easily flakes off.

Scale stability is a desired feature in reducing corrosion rates. Once a dense iron-sulfide scale is established, continuous corrosion proceeds at a low rate. In operation, scales can be jarred loose by mechanical means; or by rapid temperature changes resulting from the difference in thermal expansion of the scale and the metal; or by oxidation, which causes the scale to shrink and spall off.

Removal of the protective sulfide scale exposes bare metal to the returning sulfide reactions. This results in a



CATALYTIC REFORMER flow sheet. Fig. 2.

periodic returning of the steel to high initial corrosion rates.

Loose scales interfere with the operation of the unit. In some instances these scales have plugged equipment, causing high pressure drops across the reactors; they also have fouled heat exchangers and the heater tubes of furnaces, causing poor rates of heat transfer. Some companies report catalyst poisoning by iron sulfide.

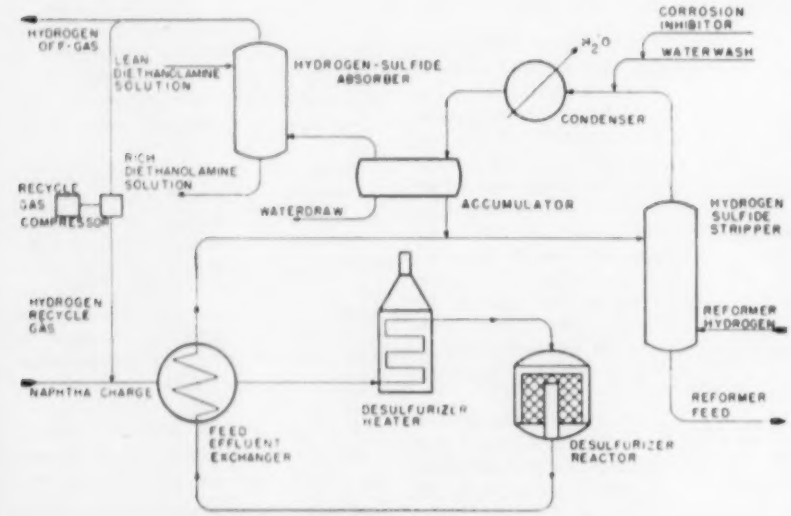
Richfield's Units

Richfield Oil Corp.'s catalytic reforming unit is process-designed by Sinclair Research Laboratories, and it will use Sinclair-Baker catalyst. Charge capacity is 17,000 bbl. per day. It is located in the Watson refinery at Wilmington, Calif., and is scheduled for completion in June 1956.

The nature of the reformer feed stock, which consists of straightrun naphtha and viscosity-breaker naphtha, is such that pretreating in a hydrodesulfurization unit is required. This pretreatment saturates olefins in the cracked components of the feed and removes sulfur, nitrogen, and other reformer-catalyst contaminants.

A flow diagram for the reformer is shown in Fig. 2. Fig. 3 is a flow diagram of the hydrodesulfurizer.

Fixed operating conditions . . . In order to accomplish the desired reactions in these units, elevated temperatures and high hydrogen partial pressures are necessary. The reformer-reactor inlet temperatures will range between 900° and 975° F., depending upon the catalyst activity and reformate octane desired.



HYDRODESULFURIZER flow sheet. Fig. 3.

The desulfurizer-reactor temperature will be approximately 780° F. In both processes a high partial pressure of hydrogen is required. This is accomplished at moderate pressures, by employing a high molal recycle-gas ratio, which increases the hydrogen concentration.

Variables . . . There are several factors which influence the rate of corrosion. These include: duration of exposure, total system pressure,[2] temperature, concentration of hydrogen sulfide, and materials of construction.

In order to plot corrosion rates on a simple graph, three of these variables have to be eliminated or fixed. Two noteworthy systematic investigations of the influence of all these variables on corrosion have been carried out.[3 4] The more inclusive study is the one by Socony Mobil Oil Co., Inc., reported to a South Central regional meeting of the National Association of Corrosion Engineers, in October 1955.

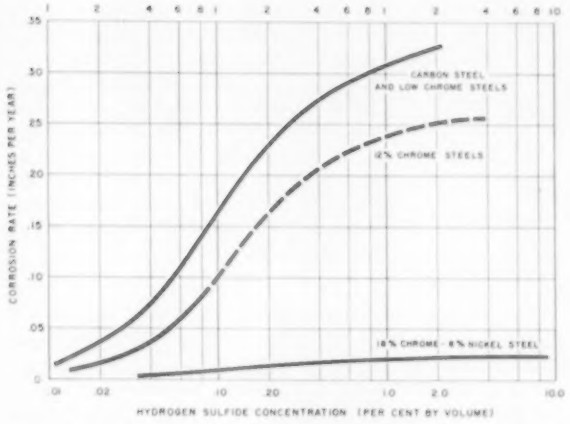
Both studies show that rates of corrosion are high during the first 100 hours of exposure, because rates are inversely related to scale thickness. Protection afforded by the scale reduces the rate to a relatively constant figure after 400 hours. In addition, little effect of pressure has been noted on corrosion rates when system pressures have exceeded 400 psig.

By thus "fixing" the first two variables—time of exposure and pressure—the rates of corrosion, as affected by material and hydrogen-sulfide concentration, could then be plotted for the average reformer-reactor and desulfurizer-reactor temperatures.

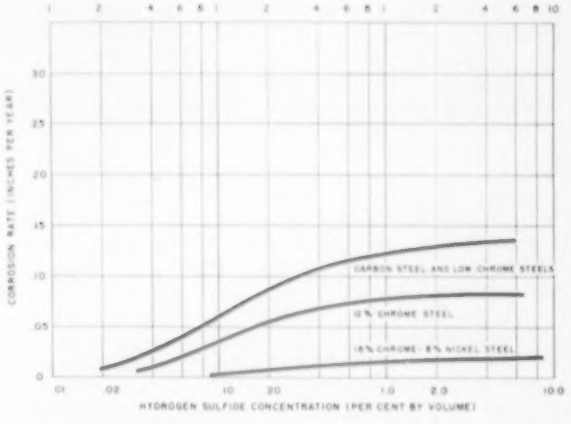
Anticipated maximum rates . . . In this survey the materials of construction were grouped in three categories with increasing corrosion resistance: carbon steel and low-chrome steels, the 12 per cent chrome steels, and the 18-8 chrome-nickel alloys. No significant difference in corrosion rates was found for the group of 0 to 9 per cent chrome steels; they exhibited the poorest corrosion resistance.

The intermediate group of 12 per cent chrome steels exhibited under mild conditions, i.e., at moderate temperatures and low hydrogen-sulfide content, corrosion rates which were approximately 50 to 65 per cent of those experienced with low-chrome steels. Under severe conditions corrosion rates of this intermediate group have been found as high as for the low-chrome steels.

The 18-8 chrome-nickel alloys have consistently provided the best corrosion resistance. Corrosion rates were found to increase very rapidly with hydrogen-


CORROSION RATE (INCHES PER YEAR)
1 — CARBON STEEL AND LOW CHROME STEELS
12% CHROME STEELS
18% CHROME - 8% NICKEL STEEL
HYDROGEN SULFIDE CONCENTRATION (PER CENT BY VOLUME)

ANTICIPATED MAXIMUM CORROSION RATES in catalytic reforming equipment. Fig. 4.


CORROSION RATE (INCHES PER YEAR)
CARBON STEEL AND LOW CHROME STEELS
12% CHROME STEEL
18% CHROME - 8% NICKEL STEEL
HYDROGEN SULFIDE CONCENTRATION (PER CENT BY VOLUME)

ANTICIPATED MAXIMUM CORROSION RATES in hydrodesulfurization equipment. Fig. 5.

sulfide concentrations in the range from 0.01 to 0.10 per cent by volume. At 1.0 per cent by volume the rate is approximately double what it is at 0.1 per cent by volume. Relatively little increase is found in the range from 1.0 to 10.0 per cent by volume.

Because of this almost parabolic relation between hydrogen-sulfide concentrations and corrosion rates, it was natural to plot the hydrogen-sulfide concentrations on a logarithmic scale. Figs. 4 and 5 give the curves showing the anticipated maximum corrosion rates in catalytic-reforming and in hydrodesulfurization equipment, respectively.

Hydrogen-sulfide removal . . . The corrosion-rate curves leave no doubt that the solution to the high-corrosion problem lies in either employing 18-8 chrome-nickel alloys or reducing the hydrogen-sulfide concentration to a very low level. The quantity of sulfur in the feed stock and the recycle-gas ratio fix the hydrogen sulfide content in the recycle gas and, thereby, the hydrogen sulfide concentration in the whole high-temperature system.

Because of the high recycle ratios generally employed, even a low sulfur concentration in the feed can create high hydrogen-sulfide concentrations in the system. Amine scrubbing of the recycle gas for hydrogen sulfide removal eliminates the major influence of the recycle ratio, and a marked improvement in corrosion rates can be obtained.

Metallurgy was selected on the basis of a maximum allowable corrosion rate of 0.05 in. per year for vessels, furnace tubes, and transfer lines, and of 0.03 in. per year for heat-exchanger tubes. In this application these are considered tolerable corrosion rates.

We realize that, even at these rates, a considerable amount of corrosion scaling can take place. In the radial-flow reactors, allowance was made for scale collection and no high-pressure drops across the reactor beds are anticipated.

Reformer metallurgy . . . It is expected that by hydrodesulfurization of the reformer feed stock the sulfur content in the naphtha will be reduced from 0.35 to below 0.01 per cent by weight. For this low-sulfur feed stock the hydrogen-sulfide concentration in the reformer system will approximate 0.015 per cent by volume.

Fig. 4 indicates that, for this concentration of hydrogen sulfide, low-chrome alloys can be used safely. The chrome level is dictated by the required resistance to hydrogen attack (see Fig. 1). Because of its better mechanical properties, higher strength, and better carburization resistance, 1¼-½ chrome-molybdenum steel was preferred above, say, 5-½ chrome-molybdenum steel for vessels, heat exchangers, and transfer lines.

For the heater tubes, 2¼-1 chrome-molybdenum steel was selected. The reactor vessels are made from carbon steel and are lined internally with an insulating refractory so as to maintain shell temperatures below the level at which hydrogen attack might occur. The internals of the reactors are made of 18-8 chrome-nickel alloy, type 347.

Carbon steel is used throughout below 500° F. The metallurgy is shown in Fig. 6. The selection is fairly well established by practice and is comparable to many low-sulfur-feed reformers.

Amine scrubbing . . . Actually, by hydrodesulfurization of the reformer feed stock the severe corrosion problem in the reformer at 950° F. is substituted for a milder one in the desulfurizer at 780° F. The same environment exists, but because of the lower temperature, corrosion rates are approximately 60 per cent less. The sulfur content in the combined straightrun naphtha and viscosity-breaker naphtha feed stock to the desulfurizer is expected to be approximately 0.35 per cent by weight.

This would bring the hydrogen sulfide content in the hydrogen recycle stream to approximately 0.78 per cent by volume. Fig. 5 indicates that this concentration, even at 710° F., can cause corrosion rates in the heater tubes as high as 0.10 in. per year unless high-chrome or stainless steels are employed. Corrosion rates in the reactor-effluent transfer line and heat exchangers would be even higher.

Amine scrubbing of the desulfurizer recycle gas has been deemed compulsory economically. It is estimated that the hydrogen sulfide removal on the recycle stream will reduce the hydrogen-sulfide content to below 0.012 per cent by volume in the recycle gas, to 0.010 per cent by volume in the combined feed, and to 0.25 per cent by volume in the desulfurizer-reactor effluent.

Desulfurizer metallurgy . . . Even should 10 per cent of the sulfur in the naphtha feed stock crack to hydrogen sulfide in the heater, predicted maximum corrosion rates from Fig. 5 are still low enough to permit the use of low-chrome steels in heater tubes and transfer lines ahead of the reactor.

The desulfurizer reactor is lined with 18-8 chrome-nickel alloy, type 347; the reactor internals are also of this material. For the reactor-effluent transfer lines, 12-½ chrome-molybdenum steel was selected. The 12 per cent chrome steel looks feasible for long-time service in this environment, especially if it is true that after some initial corrosion, because of the outward iron diffusion, a high-chromium layer will be reached.

For the effluent-exchanger tubes 18-8 chrome-nickel alloy was selected. Again, carbon steel is used throughout

below 500° F. The metallurgy is shown in Fig. 7.

Other features . . . Alternate oxidizing-reducing conditions in the heaters are avoided in the regeneration step. Also, air is excluded from the feed tanks by gas blanketing, which reduces the fouling of heat exchangers and heater tubes.

Preparations have been made for continuous corrosion evaluation. The severity of corrosion can be diagnosed from operating conditions, quantitative analyses for corrodents, and corrosion-rate measurements.

Hydrocarbon and water samples are required for corrosion-study analyses. Allowance has been made at the units for 1-in. valved connections, so that samples of feed, products, and all intermediate streams can be obtained to determine the concentrations of corrodents present.

Anticipating corrosion . . . Objectionable corrosion rates may be experienced in heaters, feed-effluent exchangers, and transfer lines over 600° F. We are considering the continuous determination of corrosion rates by means of installing 1-in. bypasses around the first exchanger in the reactor-effluent lines of the reformer and desulfurizer. In these bypass lines will be located a 3-in.-diameter spool section, with a blind flange for insertion and removal of test coupons.

A similar bypass may be installed in the line from the desulfurizer heater to reactor. The bypasses will be blocked with 1-in. valves. The test spools will contain up to 20 specimens, allowing for duplicate and accumulative corrosion-rate determinations. In addition, specimen racks may be inserted at other locations which would be accessible only during unit shutdowns.

High-temperature corrosion can be kept to a minimum by proper operation of the hydrodesulfurizer, amine-scrubbing system, and hydrogen-sulfide stripper. Continuous stream analyses will help to control operation of the units.

Low-temperature corrosion . . . Wherever liquid water is present, low-temperature corrosion may occur, because the sulfides and/or chlorides create acidic conditions. Serious damage can occur by aqueous hydrogen sulfide attack in the hydrogen sulfide stripper overhead system, where a water wash will be applied to remove ammonia. The environment here is also conducive to hydrogen blistering.

Three hydrogen probes will be installed in the condenser effluent stream and in the vapor and water phases of the overhead accumulator.

The second location where low-temperature corrosion may occur is in the reformate stabilizer and overhead system. At both locations a 1-in. valved connection was installed ahead of the overhead condenser so that a corrosion inhibitor can be introduced without delay if experience dictates the need. Filming amine inhibitors in the low, normally applied concentrations are said to have no detrimental effect on the platinum-catalyst activity.

In addition, several 1-in. valved locations are allowed for a retractable corrosion-meter probe. This corrosion meter, or corrosometer, has been designed by Crest Research Laboratories. It is a promising tool which is still in the development stage. Corrosion rates can be read continuously and are related to a change in the electrical resistance of a wire in the corrosive medium. Mechanical limitations have to be overcome before this tool can be used in high-temperature applications.

Acknowledgment

The authors wish to express their appreciation to Richfield Oil Corp. for permission to publish this paper. Thanks are due to E. C. Herthel for his guidance in the planning and coordination of all phases related to the new units, including the corrosion study. We are indebted to Sinclair Research Laboratories for use of some of their corrosion-rate data.

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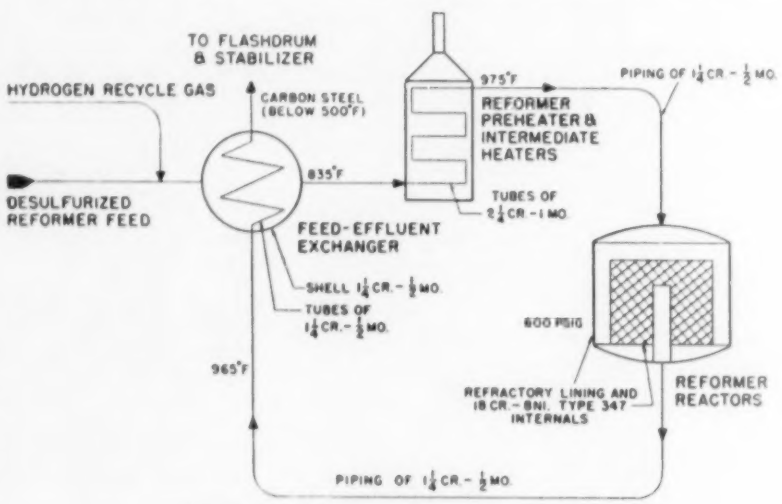
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REFORMER REACTORS
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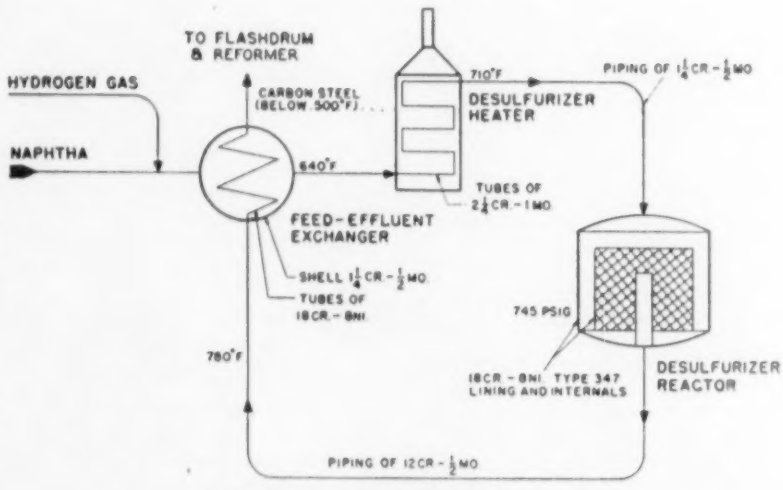
METALLURGY of the catalytic reformer. Fig. 6.



METALLURGY of the hydrodesulfurizer. Fig. 7.

Here's where we are and where we're going on . . .

Automatic Process-Stream Analyzers

A number of units are now available—others based on measurement of chemical composition are being developed

by T. C. Wherry

FROM established laboratory techniques a number of automatic process stream analyzers have been developed and applied. Typical examples include differential refractometers controlling distillation of close-boiling fractions of pentanes, hexanes, and heptanes; an infrared analyzer and ultraviolet analyzer alternately controlling an extractive distillation column (one for fine control and the other for coarse control); and an analyzer utilizing a chemical reaction combined with physical measurement to control trace amounts of oxygen in the range 0-50 p.p.m.

A promising new technique for continuous process analysis is gas chromatography. Much further use of the available instruments is possible, but progress in application is primarily up to the processing companies because of their large stake in the outcome.

Control problem . . . The continuous measurement and control of end product specification quality is frequently very difficult to accomplish. In the oil industry there are many examples of this type of measurement, such as octane number, boiling range and Reid vapor pressure. The physical factors which contribute to these qualities are too numerous and obscure to permit accurate determinations of product quality from a set of fundamental measurements.

So product quality is determined by measuring the product's performance under closely controlled standard conditions. There is no fundamental reason why it will not some day be possible to control specifications from basic measurements. In fact, this trend seems to be growing. Meanwhile, the requirement for continuous measurement of these qualities must be achieved by mechanization of the standard procedure. This has been accomplished for boiling point range and Reid vapor pressure but not for octane number.[2]

Considerable progress has been made toward the development of instruments for the continuous measurement of chemical composition. This has been made possible by the enormous expansion in methods and procedures for laboratory analysis.

Analytical laboratories have drawn upon virtually every scientific field for the basic methods of measurement which they use. Table 1 lists some of those which have already been developed into automatic plant-stream analyzers. This list is probably not complete but it will serve to illustrate the methods of measurement currently being used for continuous analysis.

Nonselective Methods

The nonselective techniques are not only simpler in concept and application but usually lead to less-expensive and more easily maintained instruments. Consequently, they have been used frequently in spite of their apparent limitations for chemical analysis. Ac-

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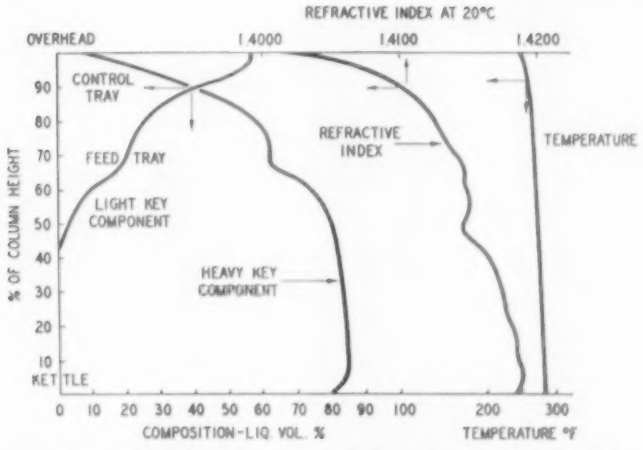
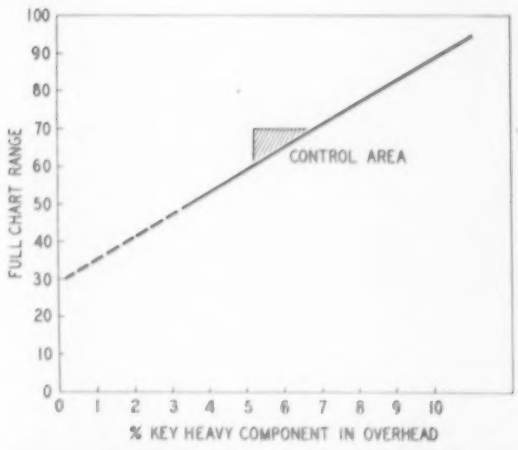
TABLE 1

Some of the Basic Systems of Measurement Which Have Been Used for Process Stream Analyzers

1. Nonselective methods:
   - Refractive index
   - Dielectric constant
   - Specific gravity
   - Thermal conductivity
   - Electrical conductivity
   - Viscosity
   - Color
2. Selective methods:
   - Infrared absorption
   - Ultraviolet absorption
   - X-ray fluorescence and absorption
   - Electrometric titration
   - Mass spectrometry
   - Chemical reaction combined with physical methods of measurement



COLUMN GRADIENTS for a methyl cyclopentane-cyclohexane separation. Fig. 1.



CONTROL CHART RANGE as a function of key heavy component in overhead. Fig. 2.

tually they are much more useful for process control than one at first imagines.

This is true because: (1) a surprising number of plant streams can be handled as though they were binary systems, and (2) an accurate determination of quality is not always necessary in order to achieve improved control of the process. If the relationship of product quality to measured variable is always in the same direction, satisfactory control may be possible.

Refractive index . . . This is a typical example of a nonselective method of measurement which has been found very valuable for controlling the fractionation of complex hydrocarbon mixtures.[3] One of our plants uses a number of these instruments to control the separation of extremely narrow-boiling-range fractions of pentanes, hexanes, and heptanes in natural-gasoline streams.

To illustrate the value of refractive index some data will be presented on a methyl cyclopentane-cyclohexane separation. Fig. 1 shows column gradients of the heavy component, the light key component, the temperature, and the refractive index. The scales of temperature and refractive index were chosen to represent the relative sensitivities of the detection instruments. This shows that refractive index is clearly the better controlling method.

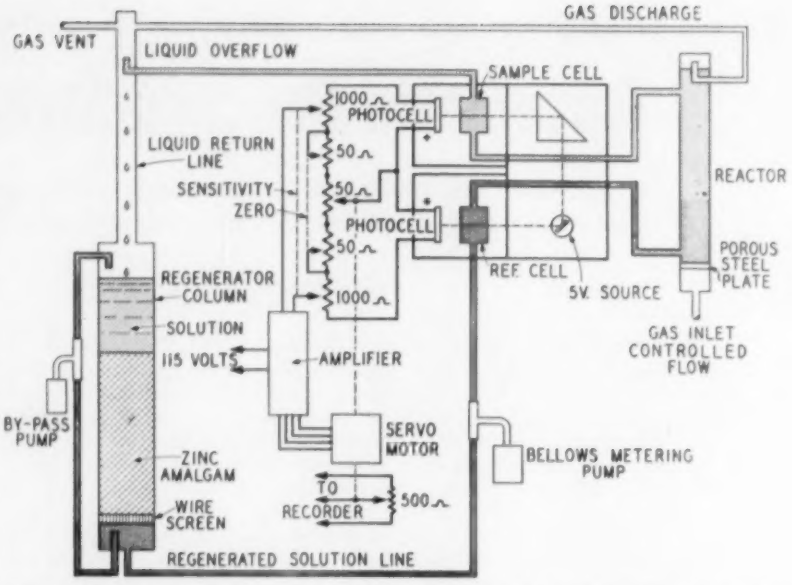
The control tray and overhead product is shown in Fig. 2. When the column was operated with refractive index resetting the overhead product flow controller, the cyclohexane in the overhead varied less than 1.6 per cent total deviation; one-ninth of that experienced when the column was operated on manual rate of flow control. To maintain this same separation by temperature the control tray temperature would have to be maintained to 0.7° F.

One of the important advantages of refractive index over temperature as a means of composition measurement is that it is not affected by changes in the column pressure.

Selective Methods

The selective methods are even more powerful tools for the continuous control of chemical composition. They are more capable but at present more expensive and more complex. Of the six different techniques listed here, infrared is probably most widely used. Well over 1,000 infrared analyzers have been sold in the United States. The current sales are around 200 a year, and this rate is increasing by 30 instruments a year. It is interesting to note that nearly one-third of these are used in the petroleum industry.

Every chemical component (if it absorbs infrared radiation at all) will have a characteristic absorption. This characteristic absorption will differ for each chemical compound. This difference is utilized as a means of determining one of the constituents of a mixture.



OXYGEN ANALYZER is good example of the selective method of measurement which utilizes chemical reaction combined with physical methods. Fig. 3.

It should be pointed out that one of the difficulties which is slowing down the extended use of this principle arises from the problem of sensitizing an infrared analyzer to the particular measurement problem at hand. Every application must be evaluated independently, and it may require from 1 day to several weeks to work out a suitable answer.

Nevertheless, infrared is the most useful method presently available for determining the composition of petroleum streams.

Ultraviolet . . . The principles of ultraviolet absorption are very similar to that of infrared but the particular apparatus for making the measurement differs. The various techniques which have been used for process control are usually more complementary than competitive. The capabilities and limitations differ sufficiently that each finds itse area of use.

As an example of the value of both ultraviolet and infrared methods, an application will be briefly described where both are alternately used to control an extractive distillation column.[5] The ultraviolet instrument is used for coarse control when the system is coming on stream or is momentarily upset. The infrared analyzer is used for fine control (as sort of a vernier) when process is on stream.

Butadiene is separated from 1-butene by solvent extractive distillation in a 100-tray furfural absorber. Typical analyses of the absorber streams are shown in Table 2. The critical consideration is to keep a low concentration of 1-butene in the kettle product. It is the only point where 1-butene can be eliminated. In the final finishing column it appears as an impurity in the butadiene product. At the same time loss of butadiene in the overhead product of absorber must be held as low as possible.

This column is very sensitive. It cannot be operated properly by manual adjustment of process control settings based on hourly laboratory analyses. Improved, but not completely satisfactory performance, was obtained by installation of an ultraviolet analyzer continuously measuring and controlling the butadiene concentration on the twentieth tray.

Recently an infrared analyzer was successfully applied to accurately control the 1-butene concentration on the

TABLE 2
Typical Analyses of Furfural Absorber Streams
(Butadiene purification section)

	Composition, mole per cent		
	Feed	Kettle product (C_4 hydrocarbons in furfural)	Overhead product
Isobutane	1.5	0.0	3.0
Isobutylene	1.5	0.0	3.0
1-Butene	47.0	1.0	70.0
1,3-Butadiene	29.0	90.0	0.2
n-Butane	4.4	0.0	10.0
2-Butene (trans)	13.0	8.0	13.0
2-Butene (cis)	3.6	1.0	0.8
	100.0	100.0	100.0

What about the bits for this location?

This is wildcat territory! But you know... *from long experience*... that Hughes bits of the right sizes, types and design will be ready for delivery before you spud in.

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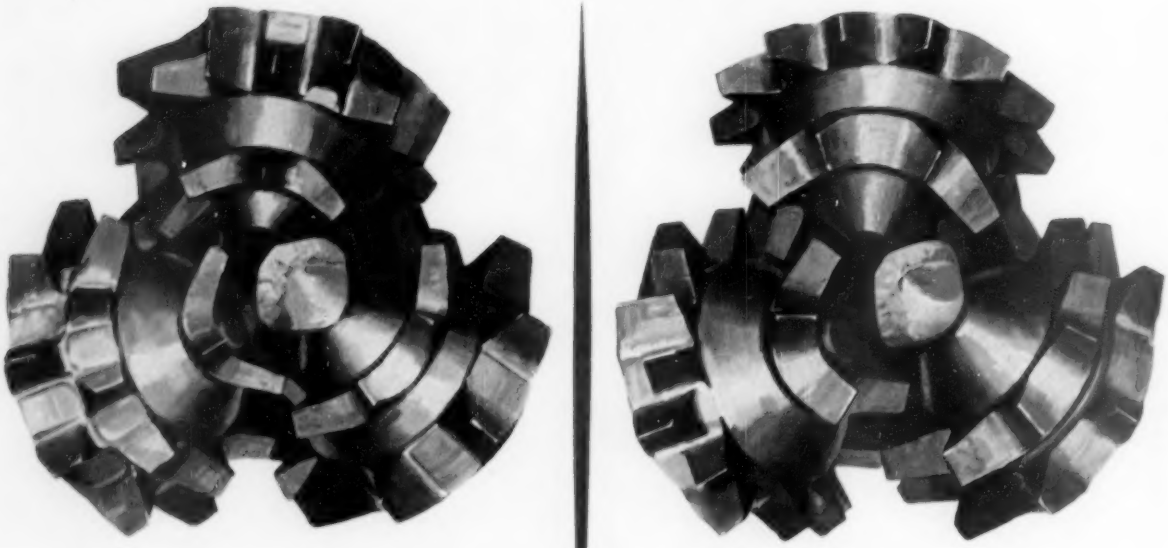
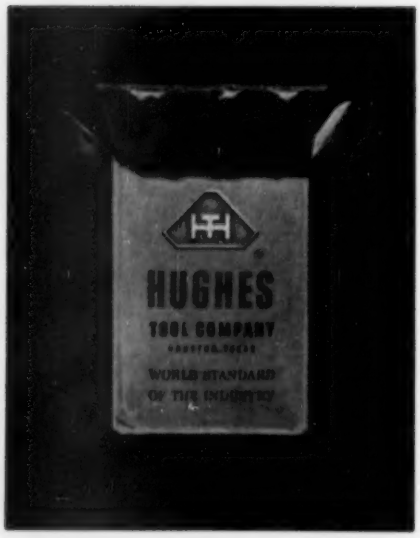
THEY LOOK ALIKE ... but



there's a difference in their performance



The two rock bits pictured here are excellent examples of the fact that bits that may look alike don't always perform alike.

Both bits are similar in design. But changes have made the second bit a faster cutting, better-performing, more versatile bit ... capable of drilling a wider range of formations.

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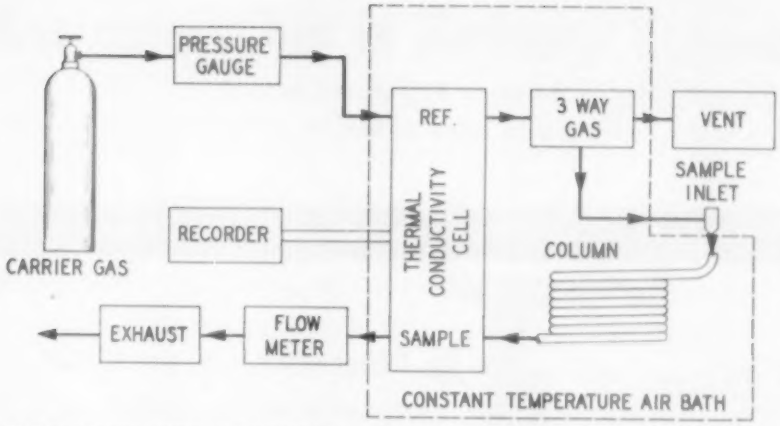

CHROMATOGRAPHIC APPARATUS has exciting possibilities for laboratory as well as continuous process control. Fig. 4.

twentieth tray in the range of 4-5 per cent. Outside of this range the infrared instrument is not sufficiently accurate to maintain control. The operational advantages of both instruments are obtained by using them alternately. Each in its turn controls the column by resetting the lean furfural flow rate.

Liquid streams . . . It has been easier to apply infrared and ultraviolet process analyzers to gas streams. But they are also used on liquid streams. One such application is an infrared analyzer which measures the concentration of water in liquid SO_2 on a gas-oil extraction unit.[6] The range of this instrument is 0 to 0.4 weight per cent water. It is a protective-type instrument which warns operators of the buildup of water to dangerous corrosive levels.

Mass spectrometers have a lot to recommend them as process stream analyzers.[7] They have been used for this purpose but up to now not so extensively in the oil industry.

Mass spectrometers are capable of fast response, will measure relatively higher-molecular-weight materials and their performance on mixtures is more easily predicted from laboratory measurements than are infrared or ultraviolet analyzers. Because of their fast response it is conceivable that one continuous plant mass spectrometer with suitable computing and data-handling apparatus can automatically analyze and control several streams in a complete unit.

Such equipment is not yet available but simple monitoring of process streams has been achieved. An example is the continuous measurement of H_2S and SO_2 in the tail gas of a sulfur-recovery plant.

The final item in Table 1, chemical reaction combined with physical measurement, offers considerable promise. There is already in existence a large untapped reservoir of chemical analytical procedures which can be developed into continuous process analyzers. This approach has two notable advantages over spectroscopic techniques. First, the measurement can be much more specific, and second, the chemical reaction amplifies the result so that the physical measurement is facilitated. This permits accurate continuous determination of trace quantities.

A good example of an instrument of this type is the oxygen analyzer shown schematically in Fig. 3.[4] Oxygen in the sample gas continuously oxidizes a reagent pumped in a closed cycle, producing a color change proportional to the amount of oxygen present. The oxygen-sensitive reagent is continuously reduced to a deep red color by passing it over a zinc mercury amalgam. Barrier layer photocells measure the differential color change produced by oxidation of the reagent.

The full-scale sensitivity of the analyzer is adjustable from 0-50 to 0-500 p.p.m. of oxygen. This instrument is specific for oxygen and high sensitivity is obtained by contacting a maximum amount of sample gas with a minimum amount of reagent.

New Techniques

Four new techniques — microwave absorption, nuclear magnetic resonance, paramagnetic resonance, and chromatographhy—are capable of being used for automatic process analysis although they are currently being developed for laboratory analysis and research studies. The first three are complex instrumental methods and their progress is likely to be slow.

On the other hand, chromatography has exciting possibilities for laboratory as well as continuous process control.[1]

Fig. 4 illustrates a gas-liquid partition chromatography unit. A mixture of the gases to be analyzed is injected into one end of the long column filled with a granular packing. The granules are coated with an inert organic liquid, which furnishes an enormous absorbing surface.

A carrier gas such as helium is used to "sweep" the sample through the column. Each component of the mixture divides itself ("partitions") in different proportions between the gas phase and that amount dissolved in the liquid layer. As the carrier gas sweeps the mixture through the column the components become separated completely because of their differing degrees of partitioning between gas and liquid phase.

They exit the column at different times and enter a detecting and measuring system, which then provides a complete analysis of the mixture.

Sampling and Maintenance

Every successful installation must have a sample preparation system which will deliver a constant, clean representative sample to the instrument with a minimum of transportation lag.

Sampling sometimes can turn out to be the limiting factor in instrument performance. The infrared instrument for water in SO_2 described previously was developed in less than 2 months. It required several additional months at the plant to find a suitable sampling point and develop a satisfactory sample preparation system.

Analytical instrument installations might be divided into three categories: (1) those which are an operating necessity, (2) those which make the operator's job easier, and (3) those which reduce cost or improve efficiency.

In the first two cases the operator can usually be depended upon to see that they are in working order. The third case, however, is frequently neglected. A little attention and aid from management will help in providing proper maintenance for these installations.

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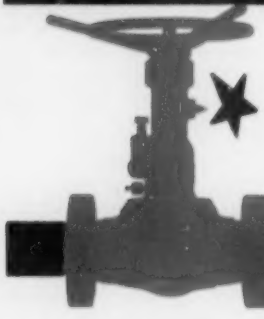

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1. Select a nucleus group with initiation of computing activity a full-time job.
2. Don't make the initial project something trivial; endow it with importance.
3. Rent the equipment, either on hourly or full-time basis.
4. If early results are favorable, consider outright purchases of equipment.
5. Operations research should work closely with computing activity.
6. Consider expansion of computer group from within, or hire trained people.

by Robert G. Donovan and Robert W. Shrage

THE most important use of computers in the petroleum-refining industry is in economic planning of refinery operations. The application of the computer in this area is not intended to reduce the manpower devoted to refinery studies. Rather, it should result in much more effective performance from the present technical staff.

By permitting comprehensive and accurate study of many problems, computers can help provide better bases for decisions.

Consistent with a policy of decentralization, several somewhat independent approaches to computing have developed within Esso Standard Oil Co. The experience cited here is that of a central staff group which provides technical service to several refineries.

These services are of an advisory nature in such matters as economics, budgets, optimum operating practices, and long-range planning.

Types of calculations . . . Of particular importance is the nature of computing work done by this group. Some of the problems which arise can be stated in purely mathematical terms. Examples of this type of problem are:

1. Solution of fairly large systems of linear simultaneous equations required for various spectrometric methods of analysis. Computers do the burdensome matrix operations necessary to give meaning to spectrometric readings.
2. Statistical analysis of process data to provide an understanding of the relationships among many variables.
3. Solution of differential equations required in certain problems of unsteady state (like catalyst deactivation).

Authors are with Esso Standard Oil Co., Linden, N. J. Paper presented at A.P.I. Division of Refining meeting, Montreal, May 14-17, under the original title, "Computers in Refinery Planning."

All of these areas of classical mathematics constitute a heavy computational workload for the technical staff.

Probably the most important application for computers, however, can be found in the "paper studies" made of the physical or economic behavior of existing or proposed processing systems. Adequate performance of this function, necessary in decision making, requires means for predicting product yields, qualities, and cost information.

These must all be expressed as functions of feed quality and controllable plant variables. While the calculations inherent in this work usually are not mathematically elegant, they are generally complex and voluminous.

Need for Machine Calculations

In 1950 both the volume and complexity of our calculations were increasing. Research programs were providing a keener insight into the mechanisms of processes; more complex mixtures were being analyzed by spectrometers, and growing product demand required more exhaustive studies of alternatives.

Nonprofessional people were being used to the greatest extent possible to carry out necessary routine calculations. The desk calculating machine proved indispensable. Special analog computers were used to solve the linear simultaneous equations obtained from spectrometric data.

Nevertheless, calculating limitations were becoming severe. Engineers were still too heavily burdened with computational drudgery. It was necessary to relieve them from this work so that they could devote more time to creative effort.

It was decided to investigate the potential of automatic computing equipment. The study was initiated by an exploration of the possible technical uses of conventional accounting machines.

Coincident with this consideration of machine techniques, an independent effort was made to systematize the procedures used in calculating the potential value of both virgin and intermediate refinery streams. These streams frequently can be used in many alternate processing and finishing sequences.

Complex economic and physical factors determine which method is best. Also, these factors are rarely constant for a long time. New answers to the same basic problems are always sought. The attempt to systematize the solution of this problem and the simultaneous study of punched-card equipment turned out to be a fortunate coincidence.

The new calculation techniques which emerged from the former study were recognized as being well adapted to machine solution.

I.B.M. Type 602-A . . . Inquiry revealed that the machine installation used for accounting included an I.B.M. Type 602-A calculator which was frequently idle. The 602-A is an electromechanical calculator representative of early, simple punched-card equipment. Its operations of card reading, arithmetic, and answer punching are controlled by a manually wired, removable control panel.

At this time a basis for cooperation between the technical and accounting organization was established. This cooperation still exists and has been mutually beneficial.

The first type of problem reduced to machine solution was the economic evaluation of refinery process streams described previously. Mathematically, this calculation bore a strong resem-

blance to a matrix-by-vector multiplication.

A special-purpose 602-A control panel was developed for this application. The success of this first attempt established a foothold. A computational bottleneck was broken by reducing a 3-hour hand calculation to a 20-minute machine job. As a result of this encouraging success, the program for exploiting computers was accelerated.

Concentrated effort was focused on a particularly burdensome calculation. This was the prediction of yields and qualities of products resulting from processing any given feed under any set of operating conditions in a fluid catalytic-cracking unit.

The numerical procedure in this calculation did not follow any characteristic mathematical pattern. Instead, it consisted of a very long sequence of trial-and-error calculations, involving many algebraic operations and frequent references to complex graphs and tables. This problem exceeded the capabilities of conventional 602-A use. Wiring this particular sequence into a control panel was impossible.

However, a general-purpose 602-A control system was devised,[1] which permitted the controlling of any sequence of operations by coding contained on punched cards (card programing). This system facilitated completion of this project and placed the computing activity on a solid foundation. The way was clear for extension of the same concept to other problems. However, it was recognized that, because of storage and speed limitations of the 602-A, a machine of greater capacities was needed.

Transition to electronic calculator . . . The card-programed electronic calculator (C.P.C.) was selected as the next logical step. This machine was specifically designed for controlling a sequence of arithmetic steps by means of codes punched in cards. In comparison to the 602-A machine, its greater memory capacity, speed, and the feature of direct printing of results made it much more suitable for technical computing.

The period of waiting for delivery of the C.P.C. was marked by two signs of progress. These were:

1. A rapid growth in the use of existing 602-A procedures.
2. An extensive effort to develop a general-purpose C.P.C. coding system.

Routine channels . . . An important factor which contributed to the extensive use of the 602-A procedures was the establishment of routine channels for processing jobs. Each application was developed in such a way that an engineer initiating a problem had only to fill out a standard form with his particular data. No knowledge of the 602-A was required for this operation.

A routine procedure was set up to manage the "traffic" flow to and from the installation where the machines were operated for the technical people on a service basis. Simple procedural details stimulated heavy use of the machine and, at the same time, allowed technical people to concentrate on formulating problems and interpreting results.

This important principle contributes significantly to the effectiveness of computer use.

The self-sustaining nature of this arrangement permitted the computer specialists to concentrate on preparing for the C.P.C. The general purpose system which evolved from this proved satisfactory in the great majority of applications which followed. When the C.P.C. replaced the 602-A, a rapid increase in applications followed.

It became necessary to spread the task of computer-code preparation on a broader base. A cross-section of the technical staff was, therefore, trained in coding or programing for the C.P.C., using the standard coding system. The computer specialists were able to concentrate on new developments, while less-skilled programers maintained existing programs and created those new applications which were more straightforward.

This arrangement brought about a steady increase in the C.P.C.'s work load. Eventually, a second machine was installed. In general, this growing work load represented a more exhaustive and more accurate study of the same classes of problems. Besides carrying out yield and quality predictions for fluid catalytic cracking, the C.P.C. was also used for most of the other process calculations (visbreaking, polymerization, alkylation, reforming, etc.).

Growing Need for Computers

By July 1953 the volume of computing work was approaching the capacity of the two C.P.C. machines which were available. Even a conservative extrapolation of past growth indicated that a further expansion of computing facilities soon would be necessary. Other factors made the need for increased capacity even more obvious.

Past efforts had centered largely upon relieving technical people from routine calculations previously done by hand. Now, however, the viewpoint was changing. It was realized that computers could be used to do things which would never have been considered practical by hand calculations.

This concept of computed application first became apparent in the area of product yield and quality predictions. The necessarily orderly and logical organization of these calculations in a computer program suggested that they be considered, not as a disjointed sequence of steps, but as a mathematical model which truly simulated a steady-state process operation.

The complexity of the model was not a serious problem with computing machines available. Pains were taken, therefore, to improve the validity and accuracy of these simulation techniques, even if these improvements led to more complicated models.

Integrated model system . . . Furthermore, although mathematical models of individual processes were of great utility, a real need existed for an integrated system of models to represent an entire refinery. Most of the economic-analysis problems in refinery operations involve important interrelationships among several processes.

A mathematical model for refinery simulation with the detail, flexibility, and accuracy necessary to solve these problems was beyond the scope of the C.P.C. Not only were its calculating speed and memory capacity inadequate, but it also could not practically perform intricate logical operations (i.e., the automatic selection, on the basis of an intermediate result, of an appropriate calculation sequence from several alternates).

Interest was also growing in several mathematical techniques which were either newly developed — or at least novel to the industry. There were, for example, such optimization methods as linear programing and game theory.[2] In many practical instances these required extensive calculations for solution.

Some complex problems involving probability considerations (such as tanker arrivals, customer orders, etc.) were not practically susceptible to solution by direct analytic techniques. However, with computers available, these problems could be solved by the Monte Carlo method.[3] Also, most of the major correlations used in the mathematical models of processes were now being derived through large multiple-regression studies requiring extensive computations.

I.B.M. Type 701 Machine

As a result of growing knowledge in the use of computers, attention turned rather naturally to newer and larger calculators. The I.B.M. Type 701 electronic data-processing machine was available at the time and received detailed consideration. It is characterized by very high speed, large memory, and

the important feature of a "stored program."

Earlier machines received their instruction sequences from an external source such as punched cards or a wired control panel. The instructions for the stored-program Type 701 calculator, on the other hand, are executed directly from within the machine's primary memory, which is entirely electronic. Instruction scanning and execution proceed at very high speeds.

The efficiency of trial-and-error calculatiions is greatly improved. Instructions can be operated on arithmetically, just like stored numerical data. Thus, under some governing logical rule (like exceeding the feed capacity of a process unit), a stored instruction can be changed from one form to another.

Work with this large computer was still an experimental venture. Therefore, arrangements were made to use the 701 calculator at the manufacturer's installation on an hourly rental basis. The first project attempted on the 701 was a calculation of the best way to blend given components into regular and premium grades of gasoline. A number of these problems were solved successfully by using the mathematical method of linear programing.

Process work . . . The next step was a trial of the 701 in process-simulation work. The first effort was concerned with the operation of a fluid catalytic cracking plant, as this important process was represented by our most complicated, individual mathematical model. About 9 man-months of effort and about $3,000 worth of machine time were used in developing this program.

In 2 minutes of 701 time this procedure performed a calculation which took about 24 hours on a desk calculator, or 2 hours on a C.P.C. Furthermore, the 701 calculation was so reliable, because of being completely automatic and self-checked, that the over-all experience was even more satisfactory than these figures would indicate.

In addition to the speed advantage, there was a substantial cost saving in using the 701. Extensive use was made of this program in many optimization and investment studies which otherwise could not have been made in such detail. The real benefit of this work should not be measured in terms of the cost of calculations, but rather in terms of improvements in refinery operations which might not have occurred otherwise.

From the time when the first modest programs were developed for the 602-A calculator, the long-range target was the simulation of a complete operating refinery. The success of the catalytic cracking program on the 701 opened the way for fulfillment of that objective.

Fully automatic procedure . . . A further effort of about 2 man-years was necessary to accomplish this refinery simulation. A single fully automatic procedure was developed, which encompassed:

1. Distillation of any given crude slate at tentative cut points specified by the problem planner.
2. Visbreaking of vacuum pitch with conversion automatically maximized.
3. Catalytic cracking in two units with feeds automatically assembled and segregated according to any stated priority schedule.
4. Thermal cracking of catalytic cycle stock.
5. Blending of heating oil and other trade-gas oils to meet or exceed specifications.
6. Polymerization and catalytic hydroforming together with blending of gasoline to meet or exceed specifications.
7. Fuel disposal, calculation of manufacturing costs, over-all profit, and material balance for checking purposes.

This complex procedure involves many trial-and-error calculations. Certain operating parameters, tentatively specified in input data, may be automatically revised to meet a limiting condition such as feed capacity or product specifications.

Time variation . . . The problems already processed by this procedure have required from 15 minutes to 1 hour of machine-calculation time. The variation is governed by the nature of the problem and the engineer's judgment in specifying tentative operating conditions.

There are some important facts that should be mentioned about the mathematical models used in refinery simulation. They are based on a combination of empirical correlations, for the most part derived by regression techniques, and theoretical principles from such subjects as reaction kinetics, thermodynamics, and stoichiometry.

It is not surprising that independent groups may construct models which represent the same process, but which differ considerably in their complexity (and presumably in the accuracy and flexibility). So much depends upon the purposes for which the model will be used and the knowledge behind it, that it is difficult to compare work done by different groups. Such comparisons can be meaningful only when the full background of the model is known.

Generally, this information will not be available, since it represents an important part of a company's competitive know-how.

Planned Use of I.B.M. 705

Foundations could be laid now for the next logical expansion of computing activity. Consideration had been given to the purchase of an intermediate-sized, stored-program calculator, such as the I.B.M. Type 650. However, sufficient justification appeared to exist for acquiring a large-scale computer. At first, attention was directed towards the I.B.M. Type 704 as being naturally suited to technical problems.

Yet there were overriding reasons for continuing to coordinate accounting and technical calculations at the same installation. A cooperative study resulted in the conclusion that the 705 was more suited for such a dual purpose. Even from the technical standpoint, the 705 offered certain advantages which compensated for its programing inconveniences and decreased speed, in comparison to the 704.

Applied mathematics group . . . The next step taken after ordering the 705 was to enlarge the staff of engineers trained in the computer field. By this time the computer activity as well as newly developed efforts in operations research, statistics, and related mathematical methods had been incorporated into an applied mathematics group.

This group is presently staffed by six chemical engineers and two engineering assistants. At present the principal effort is in preparation for delivery of the 705 computer in December 1956. The extremely heavy work load involved in these preparations will undoubtedly require making further additions to this staff. Several levels of "expertness" are visualized:

Specialists: These specialists are engineers with several years' experience in computation work. Their interests are not necessarily restricted to computing, but may also embrace operations research, statistics, and other areas of applied mathematics. These people have the responsibility for developing new concepts, adapting new techniques and, in general, leading the way for further advancements.

Rotational workers: These engineers are transferred to the group on rotational assignments lasting from 1 to 3 years. Their responsibilities include problem planning and analysis, as well as programing. Because of experience obtained in previous assignments, the rotational workers are in a good position to recognize and initiate new applications.

On completion of their assignment they will be transferred out to other technical activities, bringing with them valuable experience and an ability to visualize new areas for effort.

Part-time programers: Engineers assigned to other groups may, in the

course of their duties, be called upon to program specialized computer applications with which they are most familiar. They will receive brief training from the applied mathematics group in simple 705 programing.

Nontechnical assistants: These full-time members of the applied mathematics group perform valuable service in coding, program checking, and machine scheduling.

The goal of developing further the local utilization of computers can be achieved through proper use of these several levels of personnel. An effort has been made, throughout the entire program, to coordinate activities with other divisions of Esso Standard and its affiliates.

Inefficiencies in operations and duplication of effort have been avoided by means of both formal committees and informal exchanges. A committee has been established to continue this exchange of information and expand it to include other company and affiliate locations who have scheduled 705 installations.

Benefits Expected

From this discussion it is probably apparent that the technical use of the 705 will cover two fairly distinct areas. These might be called operations control and operations planning. It may be of interest to summarize here just what benefits are anticipated in each of these fields.

In operations control the 705 will be doing certain work on a routine daily or monthly basis. Some of this was previously done by hand calculations, and a direct cost saving may be expected here.

Probably more important, however, is the more extensive and timelier coverage of control information which the 705 will provide. This should make possible quick detection of deviations from optimality in refinery operations and permit fast remedial action.

In operations planning many of the applications will never fall into any routine category. Attention will be given to experimenting with new mathematical techniques and improving models for simulation.

Use of the 705 will give an opportunity to evaluate many more alternative methods of operation. It will enable staff groups to make a more valid analysis of more complex satuations. By attacking a wider range of problems, the 705 undoubtedly will help to uncover improved methods for future refinery operations.

Future trend . . . It can be seen that the present types of applications may be considered as providing calculated results to aid in managerial decisions. In other words, the end result of the computing itself is a numerical answer. There is little doubt that in future years there will be another trend in computer application. This future trend will be automatic control of refinery units using directly integrated computers, working in conjunction with servo-mechanisms.

Before this use becomes a reality, much work will have to be done in developing control equipment and, perhaps more difficult, in mathematically expressing the abstract concepts of decision making. However, those things which can now be done with computers in operations planning are gradually providing a quantitative insight into that decision-making process. Therefore, current progress in this field is a prelude to more ambitious things to come.

Starting a Computing Activity

The refiner who desires to establish a computing activity may wish to give consideration to the following suggestions:

1. Select a nucleus group of one or two people with the initiation of a computing activity as their full-time assignment. This group should comprise chemical or petroleum engineers who have had at least a few years of refinery technical experience.

It has been generally found that this work requires people who possess an inquiring mind with good analytical ability and an aptitude for dealing in abstractions. Selection of candidates should be on that basis.

2. The initial project should not be a trivial one, but some application important enough to firmly establish the computing activity. A minimum time investment of 6 months would not be unreasonable for an initial project.

3. Long-range equipment commitments can be avoided by renting computers full time or on an hourly basis (most manufacturers and some independent service organizations maintain installations available for such "spot" use on a contract basis).

4. If the results of early efforts are favorable, the refiner may consider continuing a rental agreement, or he may decide to purchase equipment outright. Factors such as cost, obsolescence, and maintenance must be considered in this case.

5. If a group is established to carry out operations research, it should be in close contact with the computing activity. These fields, although distinct, tend to complement each other.

6. Expansion of the computer group in later years may be achieved from within, or by direct hiring of computer-trained people. However, it seems desirable to have a majority of the group experienced in petroleum processing.

7. The decision concerning where in an organization this activity should be situated should take into account the research character of work in this field. To the extent possible, this activity should be (in an organizational sense) somewhat removed from day-to-day operating pressures.

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BOOKS

HIGH TEMPERATURE TECHNOLOGY—MATERIALS, METHODS, AND MEASUREMENTS. Edited by I. E. Campbell. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 526 pp., $15.

This book offers in succinct form the highlights of research achievements to date on development of new materials of construction for service at very high temperatures. Metals engineers, metallurgists, ceramists, and chemists have combined in the research effort. Thirty-five outstanding workers in the field describe new materials, cover methods used in production, and explain techniques for measuring properties.

This book is broken down into four parts: introduction, materials, methods, and measurements. Part 2 on materials deals with properties of metals and metallic compounds. Part 3 on methods deals with sintering of materials, means of achieving high temperatures, and various types of furnaces. Part 4 on measurements deals with temperature and its measurement, mechanical properties, physical properties, and special techniques.

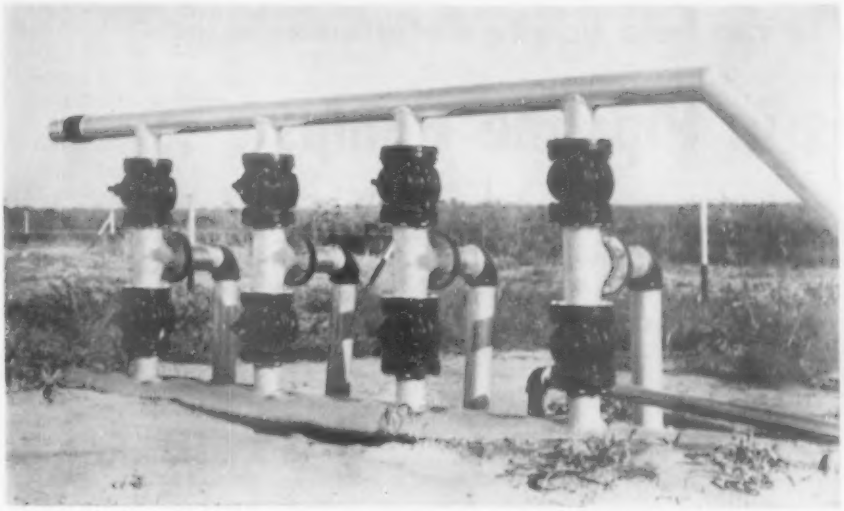
CASES AND MATERIALS ON THE LAW OF OIL AND GAS. By Howard R. Williams, Richard C. Maxwell, and Charles J. Meyers. Published by Foundation Press, Inc., 790 pp., $9.50.

Three law professors have collaborated on this text for third-year law students. The cases and discussion cover only problems unique to minerals. An unusual feature in such case books is substantial treatment of federal taxation of oil and gas interests.

"Many of the cases in this book," says the preface, "are pathological examples of the failure of parties to a transaction to think through in advance and with care the arrangements being made and to draft precise instruments achieving the results intended . . .

"The student should also note carefully the impact of history and custom on the jurisprudence of oil and gas. In few other fields of law have they played a greater part. For example, certain standard forms in common use create problems for the parties of serious difficulty and greatly increase the expense of the oil and gas industry.

It would be a simple matter for a small group of skilled lawyers, of whom there are many working in this area, to draft instruments far more appropriate for the accomplishment of the reasonable desires of the parties. Yet, older forms persist without radical revision, although occasionally a bit of patching here and there eliminates one or another of the defects."



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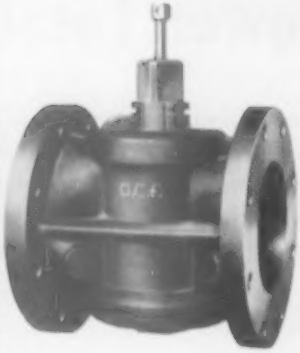

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Fluid temperature rise can help you to determine . . .

Power Losses in Pipeline Pumps

A new method has been developed whereby the temperature rise in a pipeline pump can be measured and converted to horsepower loss and efficiency. The procedure is inexpensive and simple. Numerous tests have proved the accuracy of the method.

by G. J. Jennings and L. P. Meade

THE operating efficiency of a pipeline centrifugal pump is of prime importance. As the rotating element wears, the efficiency decreases and the operator needs to know when the efficiency has dropped to the point that increased operating costs will justify the cost of reconditioning. With electric-motor drives, efficiencies can be readily determined, but with engine-driven pumps the operator cannot easily determine the pump efficiency with accuracy.

The over-all efficiency of any mechanical unit is defined as the ratio of work output to work input. In the case of a centrifugal pump, the work output is the hydraulic horsepower of the pump, and the work input, or shaft horsepower, is the hydraulic horsepower plus all the losses which occur within the pump. Therefore, if the losses can be determined, it is an easy matter to find the pump efficiency.

To determine the power losses within the pump, use will be made of the fact that all of the losses are converted to heat, which in turn raises the temperature of the flowing product stream. For an incompressible fluid, an accurate determination of the rise in temperature from the suction to the discharge of a pump makes possible the calculation of horsepower losses and efficiency in the following manner:

$$hp. = \frac{(42)\ (2.31)\ QWP}{(1{,}440)\ (33{,}000)\ g}$$

Reducing:

$$hp. = 0.00000204\ QW\ (P/g) \quad (1)$$

Where:

hp. = hydraulic horsepower.
Q = rate of flow, barrels per day at inlet conditions.
W = weight of product, pounds per gallon at inlet conditions.
P = differential pressure, psi.
g = specific gravity of product at inlet conditions.

$$L = \frac{42\ QW\ C_p\ T_1}{(24)\ (2{,}546)} \quad (2)$$

Where:

L = horsepower losses in pump.
W = weight of product, pounds per gallon at inlet conditions.
C_p = specific heat of product, B.t.u. per pound per °F.
T_1 = temperature rise across pump, °F.

Then:

$$e = 100\ hp./(hp. + L) \quad (3)$$

Where:

e = efficiency, per cent.

The authors are with Phillips Petroleum Co., Bartlesville, Okla. Presented at seventh annual spring pipeline conference and field trip, under auspices of the A.P.I., Division of Transportation, Houston, May 14, under the original title, "Determination of Pump Efficiencies From Fluid Temperature Rise."

PIPELINING

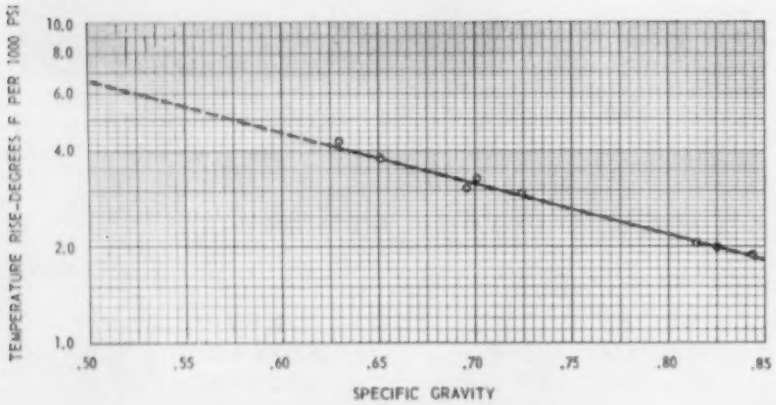


Fig. 1—Temperature rise of adiabatic compression.

Heat of compression . . . Unfortunately, the problem is not quite this simple for a petroleum product. Apart from the temperature rise caused by the heat equivalent of the power losses, adiabatic compression of a hydrocarbon liquid is accompanied by certain thermodynamic effects which cause the temperature to rise far higher than can be accounted for by the heat equivalent of the mechanical work of compression.

For example, the heat equivalent of the work required to compress motor fuel and propane to 1,000 psi. would cause temperature rises of 0.04° F. and 0.2° F., respectively. The actual temperature rise for motor fuel is about 3.0° F., and for propane, about 6.5° F. Obviously, the increase in stream temperature caused by compression of the flowing fluid should not be charged to inefficiency, and must be subtracted from the total measured temperature rise, T_r, across the pump to determine the temperature rise attributable to pump inefficiency.

To determine accurately the temperature rise due to compression, laboratory tests were made on eight hydrocarbon mixtures which varied in specific gravity from 0.6300 to 0.8434. The tests were made by quickly raising the pressure of each sample and measuring the temperature increase. Fortunately, the temperature rise was a straight-line function of pressure rise over the experimental pressure range (0-1,500 psi.). The results of these tests at a pressure increase of 1,000 psi. have been correlated against specific gravity of 60° F. (see Fig. 1). The

temperature rise of compression varies with product temperature, and the data should not be used for temperatures above 110° F. or below 40° F. To give an idea of the magnitude of the variation in the temperature rise with product temperature, isooctane (2,2,4-trimethylpentane) has a temperature rise of 3.02° F. per 1,000 psi. at 90° F., the temperature rise is 2.97° F. per 1,000 psi. These data can be developed for other temperature ranges, if necessary.

TEST DATA BY PHILLIPS PETROLEUM CO. ENGINEERING DEPARTMENT

Hydrocarbon—	Sp. gr.	°F. per 1,000 psi.
26-lb. natural gasoline	.6300	4.23
13-lb. natural gasoline	.6508	3.75
Isooctane	.6962	3.02
100-octane aviation gasoline	.7014	3.27
Refinery base gasoline	.7249	2.93
Crude oil	.8150	2.06
Furnace oil	.8250	2.00
Gas oil	.8434	1.87

Gravity correction . . . Another factor complicates the determination of the efficiency of a pump handling a highly compressible product, such as propane or butane. The specific gravity at the discharge of the pump is higher than that at the inlet, due to the compression of the product within the pump. When this occurs, use of the measured differential pressure causes the pump efficiency to appear higher than it actually is. A correction term, $(1 - a/2)$, where a is the ratio of the increase in specific gravity through the pump to the specific gravity at the suction, can be introduced to correct for the change in specific gravity.

Making the necessary corrections to Equations 1, 2, and 3 to correct for the effects of compressibility, we can derive the equations necessary for determining the efficiencies of centrifugal pumps handling hydrocarbons or other compressible liquids.

Since the total temperature rise across the pump must be corrected for the temperature rise of compression:

$$T_l = T_r - T_c \qquad (4)$$

Where:

T_l = net temperature rise for losses, °F.

T_r = total temperature rise through pump, °F.

T_c = temperature rise of compression, °F. (Fig. 1).

Correcting Equation 1 for the change in specific gravity through the pump:

$$hp. = 0.00000204\ QW\ (P/g)\ (1 - a/2) \qquad (5)$$

Combining Equations 2, 3, 4, and 5, and reducing:

$$e = \frac{[0.00000204\ QW\ (P/g)\ (1 - a/2)\ 100]}{[0.00000204\ QW\ (P/g)\ (1 - a/2) + QWC_p\ (T_r - T_c)/1,455]} \qquad (6)$$

Factoring out Q and W:

$$e = \frac{[0.00000204\ (P/g)\ (1 - a/2)\ 100]}{[0.00000204\ (P/g)\ (1 - a/2) + C_p\ (T_r - T_c)/1,455]} \qquad (7)$$

Multiplying by g:

$$e = \frac{[0.00000204\ P\ (1 - a/2)\ 100]}{[0.00000204\ P\ (1 - a/2) + gC_p\ (T_r - T_c)/1,455]} \qquad (8)$$

Which reduces to:

$$e = \frac{100\ P}{P + [336.6\ gC_p\ (T_r - T_c)/(1 - a/2)]} \qquad (9)$$

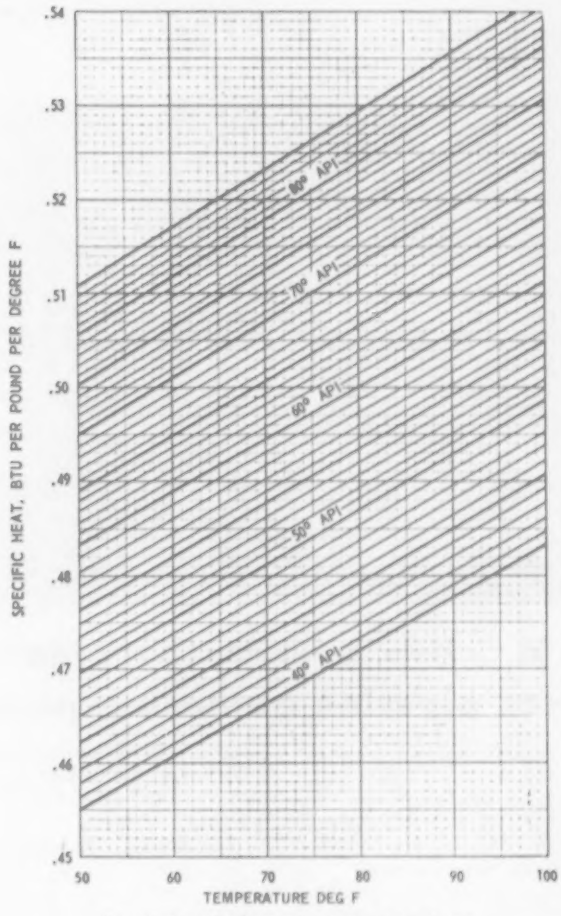


Fig. 2—Specific heat of petroleum products.

It should be noted that the pumping rate Q factors out and is therefore not needed to determine the pump efficiency. This is quite fortunate because it is often difficult to obtain the exact flow rate at the time of the test.

Although it complicates the equations somewhat, the expression $(1 - a/2)$ is retained throughout the derivation for the sake of accuracy. As noted above, the term has considerable significance for highly compressible fluids, such as propane and butane, but may be ignored for motor fuels and heavier hydrocarbons. The examples presented later ignore this term.

The specific heat of the liquid, C_p, can be found from Fig. 2, which was prepared from correlations of experimental data.[1] One should always use

the mean temperature of the liquid in the pump in determining the specific heat. The A.P.I. gravity shown in Fig. 2, however, should be that at 60° F.

Determining temperatures . . . The most difficult and critical part of the procedure is to determine the exact temperature rise of the product through the pump. Thermometer wells can be installed in the piping on the intake and discharge sides of the pump and filled with oil. A glass stem thermometer with 0.1° F. divisions can be used, and read to 0.05° F. Only one thermometer should be used, moving it from one well to the other after reading, in order to cancel any errors due to stem correction, etc., as one is primarily interested only in the temperature difference.

With a large capacity, low head pump the net temperature rise, T_1, may be only 1° F. and thus a 0.05° F. error in reading the temperature rise will result in about 1 per cent error in efficiency. However, with a low capacity, high head pump the net temperature rise, T_1, may be 5° F. and aa 0.05° F. temperature error will cause an error in efficiency of only about 0.2 per cent.

A typical efficiency test of a new pump follows:

Field data:

Product—12-lb. natural gasoline.
Gravity, at 60° F.—84.2° A.P.I. or 0.6560 specific gravity.
Pumping rate—28,464 bbl. per day.
Pump differential pressure — 1,207 psi.
Intake temperature—80.10° F.
Discharge temperature—87.55° F.
Temperature rise—7.45° F.

Calculations:

1. Temperature correction for compressibility: $T_r = 7.45°$ F.
   From Fig. 1, $T_c = 3.70°$ F. per 1,000 psi.
   $T_c = (3.70)\ (1.207) = 4.46°$ F.
   $T_1 = T_r - T_c = 7.45° - 4.46° = 2.99°$ F. net rise.

2. Pump efficiency: $e =$

$$\frac{1{,}207}{1{,}207 + (336.6)\ (0.6458)\ (0.531)\ (2.99)}$$

$= 77.8$ per cent.

The manufacturer's pump curve showed the efficiency at this rate to be 77.0 per cent.

Usually no allowance need be made for the heat loss from the bearings. With a 300-hp. ball-bearing pump this is only about ½ hp. for both bearings. Furthermore, if the bearings are cooled with the product pumped, the heat loss is accounted for in the calculation.

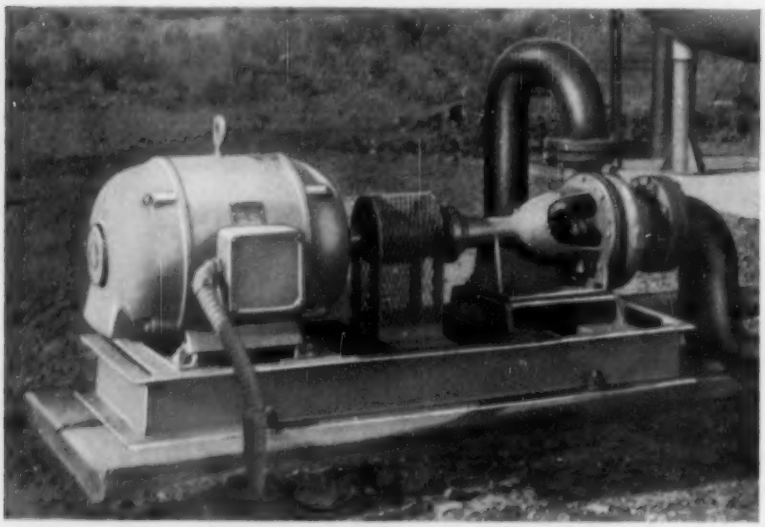
Numerous tests have proven the accuracy of the method. A 400-hp. electric-motor-driven pump was checked by the temperature method on No. 2 distillate and premium gasoline and found to be below the manufacturer's rated efficiency by 9.5 per cent and 10.7 per cent, respectively. It was checked with a watt-hour meter and found to be 9.2 per cent low. The element was inspected and the first stage was found to be badly damaged by some foreign particles. A new element was installed and the efficiency again checked by the temperature method on housebrand gasoline and found to be 0.7 per cent above the rated efficiency.

A new 800-hp. engine-driven pump was checked when installed and found to have an efficiency of 0.8 per cent above the manufacturer's rating.

Several 300-hp. engine-driven pumps were checked and the efficiency found to be 3 to 5 per cent low. A routine impeller change brought the efficiency up to the manufacturer's rating or slightly above.

Reference

1. Anon., "Thermal Properties of Petroleum Products." Miscellaneous Publications of the Bureau of Standards, No. 97, U. S. Government Printing Office, Washington, D. C. (1929).



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Pipeline Problems Also

This article discusses the experience of Great Lakes Pipe Line Co. in applying a computing machine to the problem of scheduling movement in a complex pipeline network.

PRODUCT scheduling for a pipeline network which transports several grades of products may be briefly described as follows:

Scheduling is that process which attempts to predict the future status of a pipeline system resulting from the current system status and uses this information to influence current decisions regarding shipping dates, proposed grades and volumes of movements, and proposed pumping schedules.

For the purpose of scheduling, we will define any pipeline system as consisting of one or more pipeline networks. Each network in turn consists of one or more line segments. The line segment is considered to be the elemental unit of any pipeline system. A line segment has the following properties: input facilities, pumping capacity, line fill, and output facilities.

When one or more line segments are interconnected in such a way that each segment is dependent on every other segment, the basic requirement of a network is satisfied. From this definition, it follows that pipeline networks are independent of all other networks, and may thus be scheduled separately. Individual networks of line segments always contain input points and delivery points, and in some cases, terminal points.

Delivery points accept products at the normal line pumping rate while products are dispensed from a terminal at a rate which differs appreciably from the line pumping rate. Thus, terminals are characterized by large product-storage facilities while delivery points normally require little, if any, such storage.

The input points to a network may or may not have tank storage, but always have pumping ability. In addition, at the connecting points of the line segments, transit tankage is sometimes provided. Such tankage is dedicated to the singular service of providing sufficient storage to allow two line segments of unlike pumping capacity to match pumping over a short interval of time.

In addition to the foregoing, it is of fundamental importance to note that all individual storage tanks, either transit or terminal, are dedicated for appreciable periods of time to service in a single grade. This fact is of profound significance in product scheduling.

The Great Lakes pipeline system consists of one network composed of 52 line segments, 15 terminal points, and 4 delivery points. Transit tankage and terminal tankage exist in varying amounts at the junction of each line segment. It happens that with few exceptions, the terminals are located at the junction of several line segments. The network on the average transports about 10 distinct products.

Since this network provides the services required of any common carrier, and in addition, provides warehousing and dispensing service at the terminal points, the operating objectives of the system are well defined. Within the boundaries of the existing tariff, the system must transport products from any entry point to destination with a minimum of delay and provide adequate facilities for the storage and removal of the products. In addition, the products will not be contaminated or otherwise spoiled during transit or delivery. In order that the pipeline companies' profit motive is not forgotten, the added objective of accomplishing the foregoing at a minimum of cost and with a maximum utilization of capital investment must be included.

Profit depends on scheduling . . . Given a pipeline network which is well engineered and properly operated, the degree to which these objectives can be accomplished is primarily a function of scheduling. Thus, with the poorest possible scheduling an otherwise adequate pipeline facility might tend to violate its only reason for existence. At the other extreme, optimum scheduling would assure the performance of a nearly ideal service with a maximum profit to the owners.

Practical scheduling, of course, falls somewhere between these wide limits. It turns out that the terms "poorest scheduling" and "optimum scheduling" are a good deal more easily written down than defined. In fact, in the

The author is with Great Lakes Pipe Line Co., Kansas City, Mo. Presented at seventh annual spring pipeline conference and field trip, under auspices of A.P.I. Division of Transportation, Houston, under the original title, "The Application of an Electronic Computing Machine to a Pipeline Problem."

How to decide

TO discuss the application of a specific problem to an electronic computer and at the same time to discuss the difficulties, risks, and degree of success experienced in such an application, it will be useful to examine the position of the specific problem with respect to the rather large class of problems which are being applied to computing machinery throughout the country.

In general, the problems of business and engineering which require explicit solutions fall into roughly three categories. (1) Problems for which mathematical solutions, no matter how complex, are known. (2) Problems which will yield to mathematical analysis if and when there is sufficient academic or economic interest to spark the research effort required to uncover their solutions. (3) Problems, that due to the present state of the art of mathematics, do not yield to analysis. Mathematical solutions to such problems, therefore, do not exist at present and the probability of obtaining their solutions in the near future is unknown.

Many engineering and business problems which confront the oil industry are well defined. Since their mathematical solutions are known, they fall in the first category. In such cases, the decision to apply high-speed computing equipment to their solution is based on rather straightforward economic considerations. To aid in this decision, the manufacturers of computing equipment normally offer ample assistance in problem evaluation and can be expected to submit detailed proposals covering applications to their respective equipment.

Such proposals have been found to be reliable, and in general, complete with reasonably exact costs and running times. In some cases,

Yield to Electronic Computations

by D. L. Fayman

whether you need electronic computing

the equipment manufacturer will, in fact, program the problem for his machine and offer demonstration runs for evaluation. Our experience indicates that if a problem or group of problems which are themselves well defined, are being considered for application to computers, sufficiently accurate information is available regarding cost and running time to render possible intelligent decisions.

When solutions are required to problems which have not yielded to normal analysis techniques, the decision to employ high-speed equipment to obtain partial or complete solutions is by no means straightforward. These are the problems defined in the second and third categories above. They can be solved only with extreme difficulty and are the problems with which this paper is chiefly concerned.

For a problem of this magnitude, every source of assistance in establishing the probability of obtaining solutions must be considered. Such assistance may normally be obtained from the following sources. (1) Internal research facilities. (2) Outside research facilities. (3) Company operating personnel. (4) Research and development facilities offered by equipment manufacturers.

In the early stages of a development program, the first two sources listed have proved to be the most useful. The combined efforts of company researchers and consulting scientists can be a powerful research team. The combination is valuable because the outside researchers provide the necessary academic outlook to a problem in addition to providing a large store of general knowledge and experience in problem approach. The company personnel, on the other hand, add their specific knowledge to the program, and in addition, accept responsibility for the outcome of the venture. They are, therefore, inclined to see that the investigation proceeds in an orderly fashion to the intended goal.

Once the problem is defined mathematically and a solution is proposed, the company operating personnel become invaluable in analyzing the results of the solution to determine whether or not the solution is useful. At this time, computer manufacturers will be anxious to assist in applying the problem to their specific computing equipment.

If, in the beginning, the researchers are proficient in electronic-computer applications, and have available computing equipment with which to test proposed solutions, the entire development process is greatly simplified. In fact, in the opinion of the writer, it is nearly essential that experienced computer people be engaged in the problem development program. Such experienced persons are difficult to obtain.

Great Lakes has adopted the policy of training qualified and interested employes in the techniques of computers in order to have suitable personnel to conduct this type of research. In addition, Great Lakes management has provided its computer research staff with a medium-sized electronic computer for use as a research tool. The computer research staff works in an atmosphere relatively free from undue presures common to business, and thus finds freedom of time to develop promising ideas. This far-sighted approach to computer-application research has undoubtedly hastened the advent of automatic scheduling in the pipeline industry by many years.

opinion of the writer, no satisfactory definition of optimum scheduling exists today, for this would imply the ability to compare pairs of similar schedules and consistently choose the best.

We believe that rough comparisons are possible and that within a few years highly accurate determinations will be feasible. When this problem is solved proposed schedules for any network can be evaluated and compared with optimum network performance.

At first thought, it would seem foolhardy to attempt to develop schedules which are near optimum when the very objective is not defined. The fact remains, however, that schedules have been produced for years lacking such a definition and it was felt that a search for a better scheduling method would produce useful information. To this end, in 1952 a research program was started to explore the entire aspect of scheduling. The specific goal of this research was to establish the feasibility of using high-speed computing equipment to produce schedules.

The task of defining the problem in terms of mathematics was undertaken by Midwest Research Institute of Kansas City, Mo. This fundamental work by competent mathematicians and scientists has served as a foundation for all succeeding efforts toward automatic scheduling. This work established the fact that although many pipeline operations may be defined in the form of equations, the more important areas of scheduling defy such definition.

Thus, it was found that important aspects of the scheduling problem would not yield to analysis. An effort to avoid this dilemma has resulted in several ingenious simplifications of the problem. The most promising of these involves the pumping of a predetermined sequence over every scheduling period. This method is being fully explored by Midwest Research Institute scientists who have proposed the technique.

In the summer of 1954, the research staff of Great Lakes formulated a scheme for simulating a pipeline on a high-speed computer. It was reasoned that in lieu of a complete solution to scheduling, a high-speed working model of the system would be useful. Such a model would be useful in several important ways. It would provide a proving ground for schedules.

It would allow the scheduling de-

partment to test modes of operation which it would hesitate to test on the actual system. As this work progressed, it became clear that it would be possible to simulate more than the physical aspects of a pipeline network. Using the ability of a computer to make simple numeric decisions, it would be possible to simulate such properties as good operating practice and management policies. It was further believed that an expanded pipeline model could be developed that would simulate the work of a prudent scheduler.

Management Gambles Big

To assist in the development of this idea, the management of Great Lakes not only provided research personnel, trained at company expense, but provided a medium-sized computer as a development tool. This represented a big investment with the attendant risk of failure of the program. To the people involved in the development the risk was self-evident, for failure on a sizable project can be disastrous to one's professional standing.

Well aware of the consequences of failure, the program was nevertheless enthusiastically supported by both the research staff and the management. It was simply realized that the production of better schedules for the network could spell the difference between an up-to-date and efficient transportation system and one, which left alone, could become obsolete in the future. With this as a starting point, the arduous task of converting the basic conceptions of the simulating technique to the detailed language of a numeric computer was begun.

Over a period of 18 months, several complete coding efforts for the computer were scrapped and begun anew. Each effort was, however, encouraging and each a substantial improvement over the last. At the beginning of 1956, a demonstration of the technique was given for the benefit of management. This involved the development of a high-speed schedule of a 28-day projected period for one large segment of the network. Due to the small size of the computer being used, it was impractical to attempt full scale network schedules, but the feasibility of the approach was firmly established.

Bigger model bought . . . Subsequently, a study was begun to determine the computer which would be best suited to the task of full-scale scheduling. This study was completed by March of this year. The recommendations of the computer applications group were presented to management and an order was placed for a much larger and faster machine.

"The program was enthusiastically supported by both the research staff and management. It was simply realized that the production of better schedules for the network could spell the difference between an up-to-date and efficient transportation system and one which, left alone, could become obsolete in the future."

The computer staff is presently engaged in the task of converting the latest coding effort for the small computer to the language of the larger computer. At the same time, the model is being expanded to better simulate transit tankage at the junction points and to better account for the variability of the exact system structure. The latter is important because the construction department is forever adding new segments to the network and could in time make obsolete a rigid simulating model. The larger computer is due for installation in October of this year. Allowing 2 months for a shakedown period on both the new hardware and the new machine codes, the simulator will be in full-scale operation by the end of the year.

Although the high-speed pipeline simulator is believed to be the most promising approach to automatic scheduling thus far encountered, it is by no means a complete solution to the problem. There still remains the formidable task of defining the scheduling process mathematically. This prerequisite to optimum scheduling must be the subject of future research.

The development described in this paper has covered a period of nearly 4½ years and has cost $125,700. A breakdown of this expense is as follows:

Midwest Research Institute fees	$ 22,700
Salaries	27,000
Computer rental	67,400
Office rental	4,400
Training and conference trips	2,500
Office equipment, books, and journals	1,700
	$125,700

The new computing instrument and two pieces of auxiliary punch-card equipment will be rented at an annual cost of $86,500. There will be increased costs incidential to the use of this computer. They will arise from the additional personnel and floor space required. The amounts of these costs have not as yet been determined. These expenditures are expected to be justified by the greatly improved service to our shippers that will result from the daily production of 28-day advance schedules. These schedules should provide our shippers with unprecedented control over their product stock picture. It is anticipated, of course, that with these schedules we will be able to operate our pipeline system at a higher level of efficiency than ever before to the benefit of all concerned.

In conclusion, it should be pointed out that our interest in automatic scheduling is occasioned by the inherent complexities of the Great Lakes pipeline system. We fully recognize that less-complex systems are presently being scheduled to a high degree of efficiency by hand methods. Although our scheduling problems may be an isolated case, the paper is presented in the spirit of indicating that when scheduling becomes a serious difficulty, high-speed computing equipment can be helpful.

Acknowledgments

This work is not the product of one person's efforts and the following acknowledgments are the minimum that can be included.

The author wishes to acknowledge the help of Grey Linsley, without whose leadership the project would have surely failed; John Mallas, who ably undertook the task of building a pipeline simulator on a computer; Mrs. Ruth Roudebush, whose coding efforts have been invaluable; and lastly, the management committee of the Great Lakes Pipe Line Co., whose interest, patience, and confidence have made this work possible.

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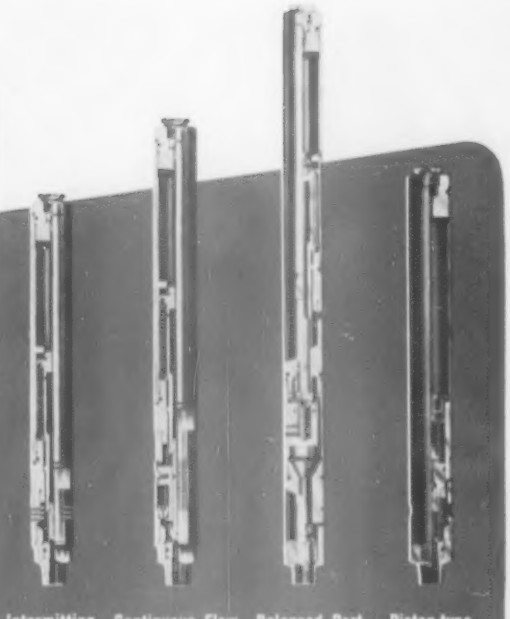

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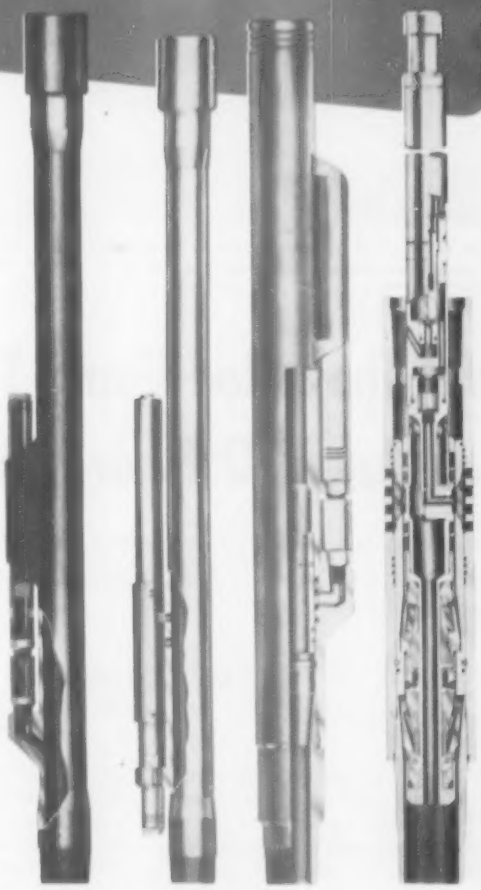

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CLOSELY SPACED on the Southwest Exploration drill site, some of these Huntington Beach producers reached drift angles in the order of 75° before being bottomed several thousand feet away.

How They Rod-Pump Those High-Angle Offshore Wells

Problems of pumping are getting rods to fall, rod stretch, and rod overtravel. Air-balanced pumping units have been most efficient.

by D. H. Stormont
District Editor

YEARS of experience in producing high-angle wells bottomed offshore from Huntington Beach has shown Southwest Exploration Co. that conventional rod-pumping equipment can give satisfactory, economical operation under very adverse conditions.

Principal problems involved in these wells, some of which have drift angles in the order of 75°, are caused by frictional forces. In wells with such deviation, which is close to the angle of rest for sucker-rod strings, most of the string's weight bears against the low side of the hole as a friction force. Viscous drag at the rod couplings and in the pump plunger, particularly in the lower-gravity oils of shallow zones, also tends to impede rod movement.

PRODUCING

Drilling angles . . . During the past 17 years the company has completed about 400 directionally drilled producers from sites on the northwest edge of Huntington Beach. About 25 per cent have drift angles in excess of 60°.

In drilling them, several hundred feet of vertical hole was first cut. Drift angle then was built up at the rate of 3° to 4½° per 100 ft. until a deviation was reached which would bottom the well within the target area.

Special effort was taken to avoid sharp changes in either drift angle or direction. It is in these doglegs that most of the wear and corrosion is encountered. The sand and mud tend to lie on the low side of the tubing and casing, remaining there while the rising fluids bypass above. Adequate cleanup of the hole at the conclusion of drilling has been found quite helpful in remedying such localized wear and corrosion.

How equipped . . . All of the approximately 400 producers are rod pumped except for 5 on hydraulic lift and a few that are still flowing. Air-balanced pumping units with a 64 to 74-in. stroke are used almost exclusively. Sucker-rod insert pumps, mostly 2½-in. with 1¾-in. bore, are used.

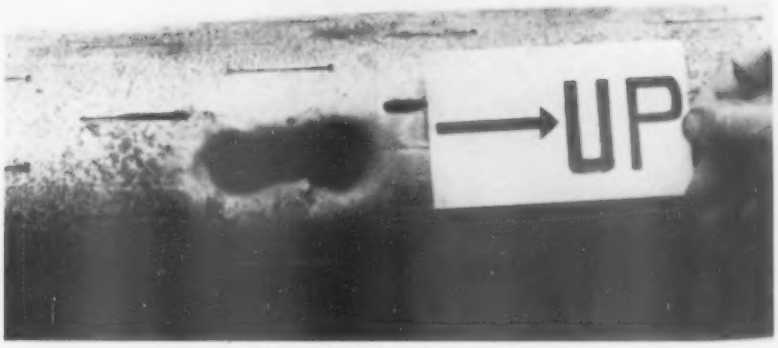
Tubing anchors are used in deeper wells, but in higher-angle wells none is required; friction between the tubing and casing is sufficient to prevent tubing movement.

Rod strings are made up of ⅞ and ¾-in. rods. The larger-diameter rods are used in the upper one-third to one-half of the string. The greater lengths of ⅞-in. rods are in wells where it is difficult to make the rods drop.

How operated . . . The air-balanced pumping units are operated at rates of 12 to 18 s.p.m. Length of stroke varies from about 54 to 64 in. No sucker-rod rotators, rod guides, or tubing rotators are used.

In many of the high-angle wells, particularly in those producing low-gravity crudes, the volume of production is determined by the ability of the rods to fall. On the upstroke, forces can be imposed through the surface pumping equipment up to the tensile limits of the rods. But on the downstroke, only applicable force is the weight of the rods. Polished-rod loads encountered in some wells range from a 12,000 to 15,000-lb. peak load on the upstroke to zero load on the downstroke.

The ⅞-in. rods are used in the upper half of the rod string both for



EFFECT of sand erosion on liner perforations.

weight and added tensile strength. In a typical 8,000-ft. well, however, there would be only some 200 ft. of vertical hole and the maximum angle would be reached between 1,500 and 2,000 ft. of drilled depth.

Drag a problem . . . In wells where 75° drift angles are attained, only a small portion (26 per cent) of the weight takes effect down the rod string. Most of the weight (97 per cent) acts as a drag to impede rod movement. In fact, the drag at 75° deviation is approximately the same as the force down the rod string (the coefficient of friction, approximately 0.3, times 97 per cent indicates a drag force of 29 per cent).

Initially some rod-box, sucker-rod, and tubing wear was experienced. In most wells, however, lubrication provided by the crude eliminates wear at the points where the rods and tubing are in contact. Only in new wells, or in those where sand erosion has enlarged perforations in the liner to such an extent that sand is being produced with the oil, does erosion offer much of a problem.

In addition to friction problems caused by high deviation angles, viscous resistance to movement is a significant factor. The shallower Jones sand wells offer the greatest problem as they not only are the highest angle wells but they also are the low-gravity oil producers.

Pumping methods tested . . . To study available pumping equipment under high-angle pumping conditions, several long-stroke hydraulic pumping units were installed. Wear on the pump barrel, rods, and tubing, it was anticipated, would be reduced because of the fewer strokes per minute. Difficulty in obtaining bottom-hole pump displacement indicated they offered no advantage over the beam pumping units.

As calculation methods normally used in vertical wells do not apply even approximately, studies were carried out in a number of wells to determine net plunger travel. They showed that with air-balanced pumping units the plunger travel often was significantly greater than the polished-rod travel. Cause for this was attributed to rod overtravel being greater than their stretch. This was not the case in the long-stroke units. Rod overtravel did not offset rod stretch so that the plunger stroke was shortened.

With this condition in mind, several tests were carried out on air-balanced units to see if production could be increased through use of more rapid, shorter strokes. Generally this proved successful but in some wells the natural fall of the rods prevented any increase in strokes per minute.

Corrosion inhibition . . . Corrosion, though no more of a problem than in straight holes, in recent years caused a steady increase in rod trouble due to increasing water cuts. Accordingly in 1952 a chemical injection program was started which is highly effective despite the increased severity of corrosion.

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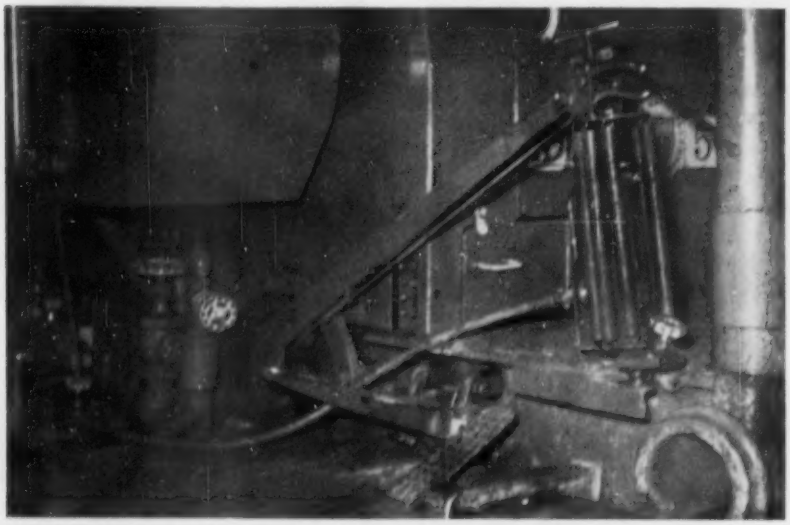

OPERATING END of the driller is this air cylinder. It works the brake when actuated by the drilling control. A surge of air lifts the brake to let out a controlled amount of line, then the heavy springs pull the brake handle back down.

FOR TRIPS, the cylinder slips easily off the brake handle to allow driller to take over. Swivel joint at bottom makes it flexible.

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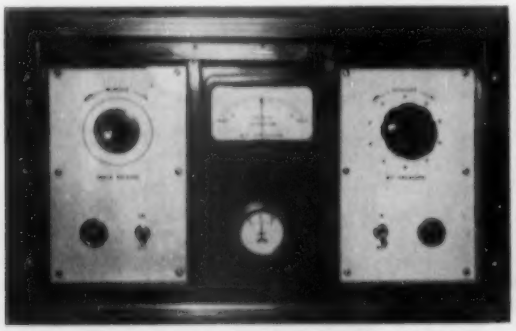
The human driller, boss man of the drilling tour, can come close to the automatic driller where drilling rates are relatively fast. But when rates slow down, fatigue sets in and he is inclined to let the bit drill off a little before letting out more line.

As a result of this human weakness, constant weight is not kept on the bit and drilling rate suffers. If the driller overcompensates for letting the bit drill off by adding a little extra weight, he then runs the risk of drilling a crooked hole.

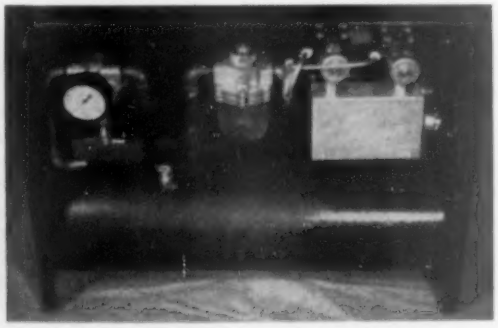
How new driller works . . . A new type of automatic driller now in use in the field is shown in the accompanying pictures. The operating mechanism is an air cylinder which works the brake handle much as the human driller would. Only this driller doesn't get tired and will hold a set weight on the bit to within 500 lb.

Control of the air cylinder starts with a sensitive weight indicator installed on



ELECTRONIC CONTROL box is the brain of the driller. After bit weight is set manually, the control is zeroed in and holds it constant. As drilling proceeds . . .

. . . this weight indicator signals the change and . . .



. . . this air control receives a signal relayed by the control box. A solenoid valve releases just enough air to the air cylinder on each pulse to hold desired bit weight.

Gas Lift Service Causes Less "SHAKE, RATTLE AND ROLL" In a BS&B Spherical Separator!

Here's An Actual Case History From Our Files:

PROBLEM:

Freeport Oil Company needed a new production battery to handle the production from 2 wells, one of which was on gas lift, at one of their leases in Bayou Choctaw Field in Iberville Parish, La. Production from the gas lift well came in "slugs" with sufficient force to cause a serious vibration problem if put into a conventional type separator.

SOLUTION:

A BS&B Model "OGS" Spherical Separator was selected because of its ability to handle these "slugs" without undue vibration, and because of its separating efficiency. To complete the battery, the operator installed 2 BS&B 500 bbl. galvanized tanks and a BS&B Model "J" Vertical Treater, making his lease 100% BS&B equipped!

RESULT:

This production battery now handles approximately 210 bbls. of oil and 150 bbls. of salt water per day. In addition, approximately 330,000 MCF per day of gas lift gas is being run through the separator with excellent operating results.

Features Of The BS&B Spherical Separator

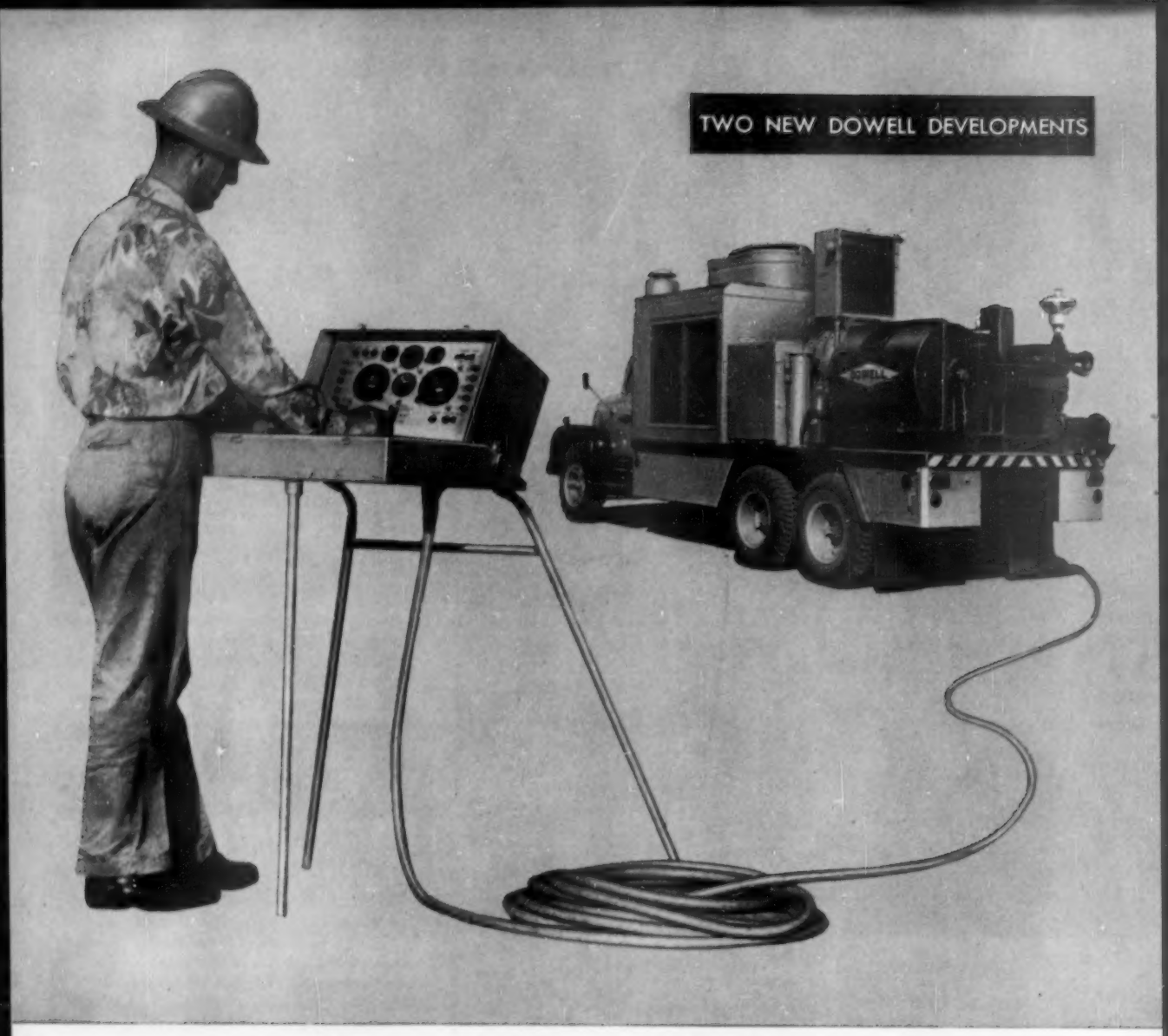
1. **Simple Hookup**
   Connections to top inlet and bottom outlets are easily made from any direction.
2. **Liquid Slugs**
   Internal design diverts liquid slugs rapidly to the liquid section.
3. **High Capacity**
   The large ratio of liquid surface area to volume in the liquid section allows rapid release of solution gas from the oil.
4. **Controls**
   All controls and valves are BS&B.
5. **Small Space Requirement**
   Compact design is a distinct advantage of the Model "OGS" over other separators.
6. **Servicing**
   Convenient access openings are provided to simplify periodic cleaning and blow-down.

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-A58

1708 West Main Street — Oklahoma City, Oklahoma



Now! Aircraft power—remote controlled for fracturing, acidizing

The 1500 h.p. Allison aircraft engine, after posting a remarkable record as a power plant for fighter planes, has been adapted by Dowell to bring you increased fracturing and acidizing effectiveness.

It's the most powerful engine in fracturing—12 cylinders, liquid cooled. And Dowell has mounted it on one truck together with the specially built DR power-frame pump for compactness, mobility and efficiency. Here's power when you want it.

In addition, you get the advantages of the revolutionary Dowell-developed Remote Control Panel—the first of its kind. This panel gives the operator complete control over engine starting, operation and shutdown from any distance up to 125 feet.

Automatic controls prevent maximum pressures and volumes from being exceeded. The entire unit shuts down when pre-set limits have been reached. Never before has it been possible to offer such safety to men and equipment.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. E-11.

services for the oil industry

DOWELL

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the dead line. This transmits an electrical current to the control box. This signal is normally balanced out, but when the weight changes, an unbalanced current results. This current is then amplified to operate a solenoid valve on the air supply. When drilling weight decreases slightly, air is released to the cylinder. It releases the brake and just enough line to bring the bit weight back to the set value. Then the heavy springs pull the brake handle back down.

To operate the equipment, the driller manually picks up the desired weight on the hook. Then he balances the electric signal by a knob on the control box. After this, he switches the air control on and drilling is on automatic. While the automatic driller is operating, he can also change the weight level and regulate the amount of line that is released on each air surge.

Normally, electric power for the unit will come from a portable generator running off a rig engine. In an emergency, a 12-volt battery will take over for 6 to 9 hours. Air for the cylinder comes from the rig supply. In case of electrical failure, a second solenoid valve automatically shuts off the air.

The automatic driller is lightweight and can be handled entirely by one man. It loads easily into the back of a pickup truck.

Units are available on a lease basis from Mud Control Laboratories, Oklahoma City.

Derrick Man's "Elevator"

THIS derrick man gets a lift from a counterweight to make his climb easier. The device is used here on a Magnolia Petroleum Co. rig operating in the San Juan basin of New Mexico to reduce the fatigue of climbing the derrick.

It is easy to make this sling. A belt for the man to sit in, a line, a pulley and a weight equal to the man's are all that are required.

It logs and perforates in one run!

HERE'S a combination logging and perforating tool that permits accurate perforating of casing with only one run into a well. The upper part of the tool contains a gamma-ray detector and circuit for transmitting the information for a gamma-ray log. The bottom of the tool is a jet perforating gun.

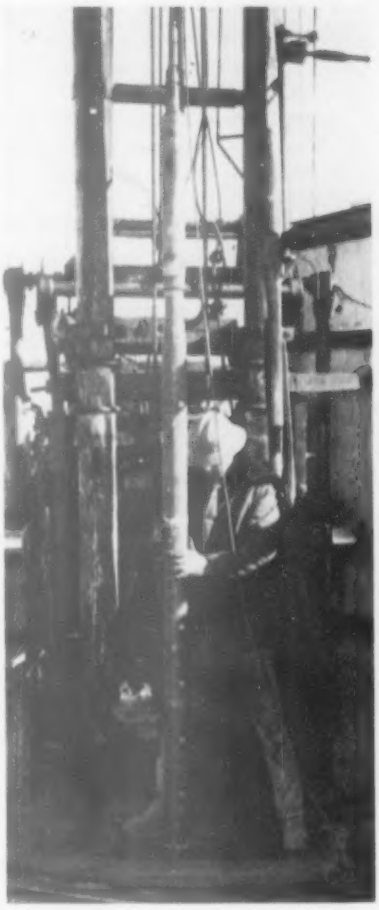
Normally, two wireline runs are required to accurately perforate a well. On the first, a gamma-ray and neutron log is made and casing collars are recorded. From the logs, the correct perforating interval is determined and checked with the collars. Then, on the second run, only the perforator and collar checker are lowered into the hole.

This new combination tool, however, makes a gamma-ray log from which the perforating interval is determined—and then it proceeds to perforate. It's all done in the same run in the hole.

While the new tool does not obtain a neutron log, it is speedy and inexpensive for perforating. In many areas, producing formations are known to have certain consistent characteristics, and the information provided by the neutron log is not needed. In such areas, the gamma ray is a reliable tool for determining perforating interval.

Special detector design protects the gamma-ray detector from the shock that occurs when the perforating tool is fired. Field maintenance is easy and logs are of the same quality as those produced by the conventional method.

Two sizes of gamma-ray detectors and four sizes of perforating guns—ranging from 3⅛ to 5 in. in diameter—have been used in the field. Bird Well Surveys of Bradford, Pa., has run the tool successfully in many wells in Oklahoma, Illinois, Indiana, Kentucky, Pennsylvania, New York, and West Virginia.



Flag signal saves false stops for gager

WEST of Plainville, Kans., on the John lease of the Heathman-Seeligs Drilling Co., the pumper uses a flag to tell the gager when he should stop to turn on a tank or make a shutoff. As soon as a tank is topped out, the pumper turns up the flag as shown and the gager sees it from the road and comes in and turns the tank into the pipeline. When he does, he lowers the flag.

Later, after the tank has been run out, the same signal can be used to show the gager that the pumper is ready for a shutoff. Of course, the gager always checks the note box for any other reason for which the pumper would need to confer with him.

Industrial Power Cycles for Oil-Industry Use—1

by Stephen Bencze

A POWER cycle may be defined as the processes and paths through which a working fluid passes, in a repeated cyclic fashion, in the production of mechanical or heat power.

Power cycles are generally classified as either utility or central-station cycles, or industrial cycles. In the central-station cycle, the prime function usually is to generate electric power. However, many existing central stations also generate steam for general consumer use.

In the industrial cycle, the prime function is two-fold: to generate electric or mechanical power, and to generate steam or heat power for use in the various industrial processes peculiar to the particular industry.

Fig. 1 illustrates a typical industrial power cycle. In this cycle, electric power is generated by the turbine-driven generator set. Mechanical power is generated in the various turbines driving the boiler feed pumps, forced draft fans, and treated water pumps. Exhaust steam for industrial process is furnished as noted.

This cycle actually supplements a separate original lower-pressure cycle by furnishing an additional 400,000 lb. per hour of process steam and 5,000 kw. of electrical power needed for chemical process expansion. Availability of 600-psig. steam and the need for 70-psig. steam in the deaerator proves economical in the use of turbine-driven auxiliaries.

The essentials . . . All power cycles consist of three essential elements: the heat source, the heat utilizer, and the waste-heat reservoir. To produce useful work in the cycle, heat must be applied to the working fluid from the heat source. This process takes place in the boiler. Useful power is obtained in the heat utilizer by converting a portion of the heat supplied to the working fluid.

Author is with DeLaval Steam Turbine Co.

There are various forms of heat utilizers, but for our discussion we will consider only the steam turbine. The second law of thermodynamics tells us that not all the heat can be converted into useful work or power, thus a waste-heat reservoir is required to dispose of the remainder of the heat.

In the usual central-station cycle, the condenser acts as the waste-heat reservoir. In the industrial cycle, the waste-heat reservoir can be the condenser, or the general plant heating system, or some industrial process requiring heat—such as a drier, batch chemical digester, etc.

Using the steam turbine as a heat utilizer in the industrial power cycle serves the purpose in many ways. As a prime mover, it is used: (1) to drive a.c. or d.c. generators and exciters at constant speed; or (2) to drive pumps, fans, blast-furnace blowers, air and gas compressors, etc., at variable speeds. In addition it also furnishes process steam as exhaust steam from the turbine for heating, drying, digesters, or any other process requirement.

The steam turbine is the most widely used industrial prime mover today. The reason for its predominance is its great design flexibility and its ability to extract power from the steam—and then exhaust all of the steam or any part of it into a manufacturing process or into a heating system completely free of oil.

The main justification for the industrial turbine is its relative simplicity, basic reliability, low maintenance cost, and ability to supply both mechanical power and heat power.

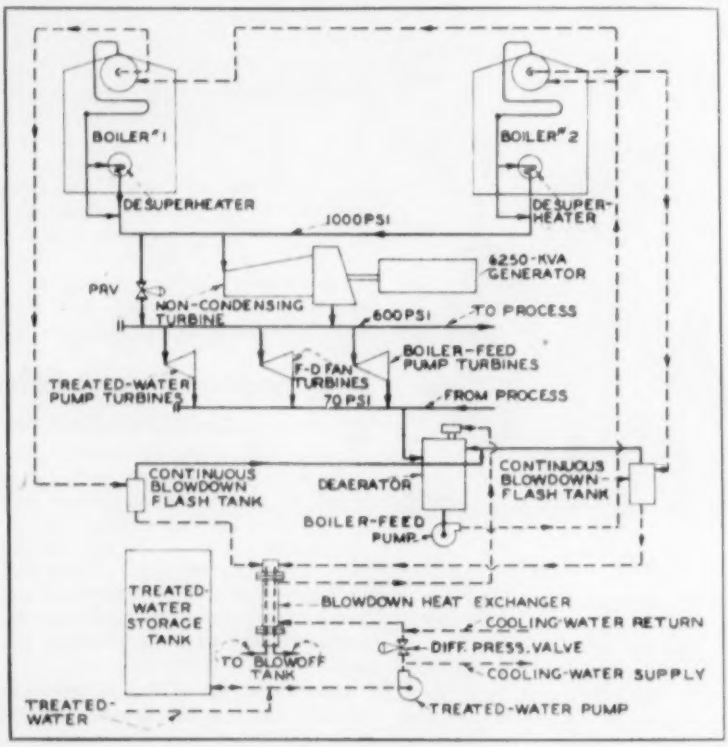
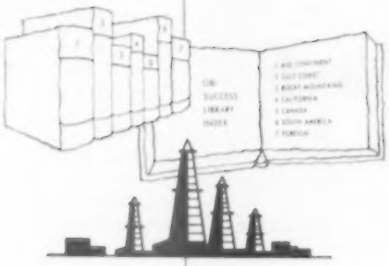


Fig. 1—Typical industrial power cycle.

IS IT PRICE OR RESULTS THAT COUNT?...



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JOB IMPROVEMENT FOR THE PROCESS FOREMAN—53

The A, B, C's of Instrumentation—6

IN modern level measurement, gage glasses are still the primary means of locating a liquid level. But, in many applications, they are very difficult to read and are not readily adaptable to recording or controlling.

Many factors determine the type of level detector to use. A tank may require a simple float with a chain, a bob, and a scale painted on the tank. A pressure vessel with hot tar in the bottom may require a heavy steel chamber totally enclosing a displacer.

Ball floats on arms inside of pressure vessels depend upon large rotary shafts through stuffing boxes in the vessel wall to indicate the level. These are subject to lost balls, coked-up shafts, and other troubles which cannot be readily remedied with the unit on stream.

The modern level instrument for both internal and external use is the buoyancy or displacer type (Fig. 33) which has no stuffing box. The displacer, which takes the place of the float, has a total travel of about ⅜ in. for even the longest ranges. This eliminates most of the pounding which floats have to take. This type must be adjusted for specific gravity of the liquid to be measured.

Another method used for long-range levels where the material is not too viscous to handle in small lines is the differential-pressure method. The manometer used can either be sealed (Fig. 34), or can use a dry leg (Fig. 35). This depends upon whether it is more difficult to keep the fluid in the high leg from evaporating when sealed, or condensing when it is supposed to be dry. This instrument must be calibrated for gravity also.

Solid granular material is more difficult to gage than liquids. It may be done by means of the "Yankee screwdriver" which consists of a rotating vertical shaft with screw-type blades on the bottom and a means of measuring the rise and fall of the shaft as it climbs to the top of the pile.

The Gagetron (Fig. 36) has no such moving parts. But it has a source, or several sources, of radium to supply radioactive gamma rays which are measured by a Geiger counter.

"Transmission" . . . This is the term used in instrument work to denote the process of conveying a measured value from some primary instrument at a remote location to some more convenient point—such as the control room for indicating, recording, and controlling. For example, the cable or chain on the tank gage (Fig. 37) is a method of transmitting the level from the float inside to the gageboard outside the tank.

The thermocouple system and the bulb thermometer system described under "Temperature Measurement" are, in effect, natural transmission systems. One of the oldest methods of transmissions still in service in the plant is the electrical induction bridge used in the Brown electric flow meter (Fig. 38), although this system has been modernized in the electronic transducer.

More universally used is one or another of the pneumatic systems. One of these (Fig. 39) takes a definite movement, such as the movement of a meter-float linkage, and converts it to a given range of air pressure. This, in turn, is conveyed by small tubing to the desired remote location where a receiving pressure gage with the proper chart or scale on it indicates, records, or controls the reading.

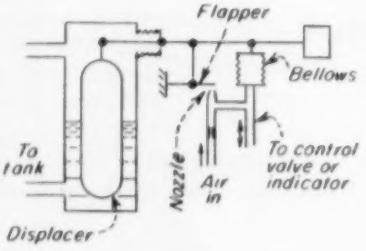

Fig. 33

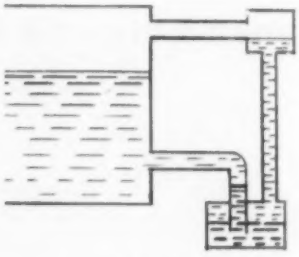
Fig. 34

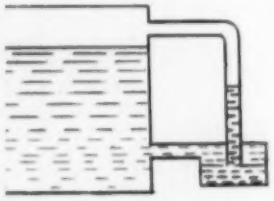
Fig. 35

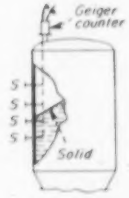

Fig. 36

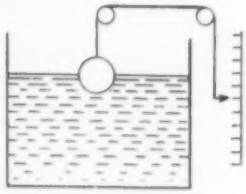
Fig. 37

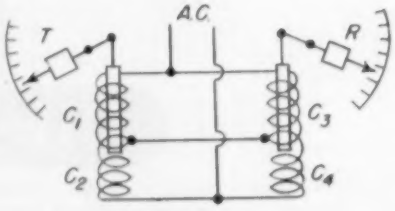

Fig. 38

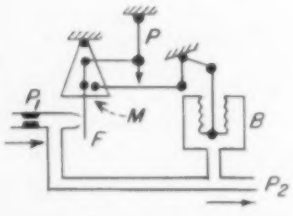

Fig. 39

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by ● preceding the project.

Crude-Oil Pipelines

Buckeye Pipe Line Co.—Will complete in October or November 1956, own reconditioning of 191 miles of 8-in. from Griffity, Ind., to Lima, Ohio.

Lakehead Pipe Line Co., Inc.—Let 51 miles of 26-in. looping in Minnesota and North Dakota, to Anderson Brothers Corp. Job to be completed summer of 1956, is in conjunction with 69 miles of 24 and 26-in. looping to be completed this summer by Interprovincial Pipe Line Co. (See Interprovincial, foreign crude.)

● **Magnolia Pipe Line Co.**—Plans 14 miles of 16-in. from Ringgold to Addington, Tex., to be completed June 1, 1956. Plans 36 miles of 12-in. from Andrews to Midland, Tex., to be completed January 1, 1957.

● **Offshore Gathering Corp., Houston.**—Proposes 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana.

● **Pasotex Pipe Line Co.**—Plans 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.

● **Shannon Oil Co., Denver.**—Plans with Farmers Union Central Exchange, Inc., and Mule Creek Oil Co., both of Billings, Mont., a 34-mile, 6-in. line from Murphy Dome in Hot Springs County, Wyoming, to contact Ohio Oil Co.'s line in Big Horn County. Construction to start in August, end by December 1, 1956.

● **Sinclair Pipe Line Co.**—Building a 300-mile line from Jacksboro, Tex., to Houston. 152 miles of 18-in. from Jacksboro to Teague, Tex., completed. Remaining 150 miles of 20-in. not yet let.

● **Tecumseh Pipe Line System.**—190 miles of 20-in. will be built by Sinclair Refining Co., Pure Oil Co., Ashland Oil & Refining Co., between East Chicago and Cygnet, Ohio.

● **Union Oil Co. of California.**—Proposes 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.

Products Pipelines

● **American Pipe Line Co.**—Received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line from Gulf Coast area to New York City area.

● **Cities Service Oil Co. & Subsidiaries.**—Plans a 10-mile, 6-in. L.P.G. line from Maysville to near Pauls Valley, Okla., to tie in to Shell line moving on to Cushing, Okla.

● **El Paso Natural Gas Co.**—Plans 240 miles of "larger than 6-in." to carry natural gasoline, butane, and propane, from its Midkiff natural-gasoline plant in Permian basin, Midland County, to El Paso. Has under way 96 miles of 8-in. in New Mexico, from its Blanco plant to its Wingate plant.

● **Gulf Refining Co.**—Will build 45 miles of 8-in. from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss. (due on stream May 1957) to a connection with Plantation Pipe Line Co.'s system. No date set to start.

Interstate Oil Pipe Line Co.—Let 25 miles of 8-in. from 12 miles south of Shreveport to Bethany, La., to C. Wayne Fowler, Pipe Line Contractor, Ins., to be completed June 1, 1956.

● **Magnolia Pipe Line Co.**—Plans a 75-mile, 8-in. L.P.G. line from Hull to Texas City, Tex., and a 30-mile, 8-in. line from Andrews to Dollarhide, Tex., both to be completed January 1, 1957. Plans an L.P.G. line, 19 miles of 6-in., 3 miles of 4-in., from Beaumont to Orange, Tex. Completion date indefinite.

● **Phillips Chemical Co.**—Plans 79 miles of 6-4-in. ethylene line from Sweeny to Pasadena, Tex., to be completed December 31, 1956.

● **Phillips Petroleum Co.**—Plans 15 miles of 6-in. L.P.G. line in Sweeny, Tex., area, to be completed September 15, 1956, and 16 miles of 3-in. product in Central Oklahoma area, to be completed June 1, 1956.

● **Phillips Pipe Line Co.**—Let 64 miles of 12-in. from Sweeny, Tex., to Houston, to be completed June 1, 1956, by H. H. Null. Plans 135 miles of 12-in. looping between Borger, Tex., and St. Louis, Mo., to be completed December 31, 1956.

Plantation Pipe Line Co.—Let 327 miles of 18-in. from Baton Rouge to Helena, Ala., to Oklahoma Pipe Line Constructors, to start June 1. N. L. Arie, spread superintendent, office at Baton Rouge. Completion set for December 1956.

● **Shell Oil Co., Pipe Line Department, Pacific Coast.**—Plans to convert 13 miles of existing 4-in. gasoline line, and add 3 miles of new line, to move gasoline from Wilmington refinery to Los Angeles. To be completed January 1, 1957.

● **Sioux Oil Co.**—Plans 80 miles of 4-in. from its Newcastle, Wyo., refinery to Rapid City, S. D., to be completed late 1956.

● **Southern Pacific Pipe Lines, Inc.**—Plans a line to span the Sierras and connect San Francisco with Reno and Fallon, Nev., and to serve the Sacramento Valley.

Sun Pipe Line Co.—Contracts let on 109 miles of 14-in. from Twin Oaks, Pa., to Newark, N. J.: Sheehan Pipe Line Construction, 90 miles from Twin Oaks to Plainfield, N. J., J. W. Brown, spreadman, office at Malvern, Pa.; Delaney-Missouri Valley Construction Co., remainder. Work to start May 1, end September 1956. The line, with 83,000-bbl. capacity, will replace present 8-in. line.

● **Sunflower Pipe Line System.**—Has Kansas Corporation Commission approval for 215 miles of 6-in. to move L.P.G. from six counties in western Kansas to Wichita.

Tennessee Gas Transmission Corp.—Contracts let for 200 miles, 6-in. L.P.G. line from Banquete, Tex., to Houston: Sheppard & Geiger Construction Co., section from Banquete to Port Lavaca; Oklahoma Pipe Line Constructors, 74 miles from there to Brazos River, Gene Gohring, spread superintendent, office at Bay City; Panama-Williams Co., section into Houston.

Non-Petroleum Pipelines

● **American Gilsonite Co.**—Plans 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.

Pittsburgh Consolidated Coal Co.—Let to

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FJuor Pulsation Dampeners and Pulsation Dampening Piping Systems are in use in refineries, cycling plants, absorption plants, transmission line compressor stations, ammonia plants – wherever air, steam, hydrocarbons are being compressed. *The most recent applications are in ammonia plant service where hydrogen synthesis gas is compressed to pressures as high as 9000 psi!*

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Pipeline Patrol

Williams Brothers, 108 miles of 10-in. from its mines in eastern Ohio to Cleveland Electric Illuminating Co.'s Eastlake power plant northeast of Cleveland. Work started April 1, 1956, on this first line to move coal, with Ford, Bacon & Davis, Inc., handling specifications, contracts, construction supervision.

Natural-Gas Pipelines

American Louisiana Pipe Line Co.—Let bulk of 1,160-mile line from North Tepetate, La., to Detroit. H. C. Price and Houston Contracting Co. have 770 miles of 30-in. from near Willow Run, Mich., to near Eudora, Ark.

Houston starts June 1 on 40 miles in Ohio, E. C. Norris, spread superintendent, office at Defiance; starts May 1 on 100 miles from east of Memphis, Tenn., working south towards Eudora, Ark., W. H. Hayes, spread superintendent, office at Collierville, Tenn.; starts May 15 on 85 miles working north from Eudora, F. A. Silar, spread superintendent, office at Eudora.

Price starts May 1 on 83 miles in Tennessee, R. L. Ezell, spread superintendent, office at Brownsville, Tenn.; 31 miles in Indiana, C. E. Shivel, spread superintendent, office at French Lick, Ind.; 83 miles in Kentucky, C. R. Ice, spread superintendent, office at Princeton, Ky.; 31 miles in Indiana, W. H. Olrich, spread superintendent, office at Edinburg, Ind.

Brown & Root has 221 miles of 30-in. from North Tepetate to Arkansas-Louisiana border (which is subcontracted to Sharon, Allen, Gay & Taylor, Inc.—formerly Associated Pipe Line Contractors—and Western Contractors), and 39 miles of 16-in. under-water line which it will lay itself. Western Contractors expects to complete its 100 miles August 1956. W. B. Williams, spread man, office at Eunice.

Has FPC permit for 117 miles of 22-in. from Payne, Ohio, to Bridgman, Mich.

• **Arkansas Louisiana Gas Co.**—Has long-range plans for line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.

Atlantic Seaboard Corp.—Williams-Austin Co. has under way 50 miles of 24-in. from Hardy County, South Virginia, to Greene County, Virginia. O. L. Martin, spread man, office at Elkton, Va.; and 37 miles of 26-in. loops along the Cobb-Rockville line in West Virginia. Ralph Gaddy, spread man, office at Elkins, W. Va.

• **Carolina Pipeline Co.**—Applied for South Carolina Public Service Commission permit to distribute gas in central South Carolina. Plans lines to 14 cities. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.

• **Carolina Natural Gas Corp.**—Proposes 185 miles of 8-12-in. laterals off Transcontinental in North and South Carolina.

Cascade Natural Gas Co.—Engineering Construction Co. started April 1, 1956, laying 400 miles of 3¼ to 12-in. distribution lines in Yakima, Grandview, Granger, Trosper, Sunnyside, Toppenish, Union Gas, Wahpato, and Zillah, Wash.

Cities Service Oil Co. & Subsidiaries.—M. L. Moore Construction Co. has 18 miles of 3 to 10-in. gathering system at Roberts Ranch near Odessa, Tex., to be completed June 15, 1956.

• **Coastal Transmission Corp.**—Applied to FPC for 565 miles of 22-26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Co.'s proposed line to Florida. Plans 272 miles of smaller gathering lines.

• **Colonial Natural Gas Corp.**—Proposes two systems: One between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.

• **Colorado Interstate Gas Co.**—R. H. Fulton has 238 miles of 22-in. from Laramie to Green River, Wyo. (last part of a 374-mile line between Denver and Rock Springs), to be completed fall 1956. Filed, March 29, for FPC permit for 1957 program: 307 miles of 30-in. from Idalia, Colo., to Beatrice, Neb., to take gas from a planned 165-mile, 26-in. line from near Carr, Colo., to Idalia, and from a 72-mile, 26-in. line from near Kit Carson, Colo. to Idalia; 215 miles of 20 and 24-in. to parallel present line from Texas Panhandle area to Kit Carson; 34 miles of 16-in. from Keyes field, Oklahoma, and Greenwood field, Kansas, to the new north-south line.

El Paso Natural Gas Co.—Has under way 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix, both to be completed February 1, 1957. Western Pipeline, Inc. has under way 146 miles of 34-in. between San Juan basin and Topock, to be completed February 1, 1957, and 112 miles of 20-in. between San Juan mainline and Phoenix, to be completed November 1, 1956. El Paso also has under way 34 miles of 24-in. from Ignacio, Colo., to the Blanco plant, to be completed October 1, 1956.

• **Empire Southern Gas Co.**—Plans a 10-mile, 8-in. line, and 5 miles of 4-in. gathering lines in Gray County, Texas, to be completed August 15, 1956. Plans a 4-mile, 8-in. loop south out of Pampa, Tex., on transmission line, and a 9-mile, 8-in. loop northwest out of Big Spring, Tex., on transmission line, to be completed September 1, 1956. Plans 6 miles of 4-in. near Big Spring, to be completed June 1, 1956.

• **Houston Texas Gas & Oil Co.**—Applied to FPC for 960 miles between Baton Rouge and Miami: 507 miles of 30-in., 157 miles of 26-in., 61 miles of 20-in., 224 miles of 18-in., 12 miles of 12-in. Plans 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

• **Iron Ranges Natural Gas Co., St. Paul.**—Applied to FPC for a 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minnesota.

• **Kansas-Nebraska Natural Gas Co., Inc.**—Plans 11 miles of 12-in. from Colby to Oakley, Kans., to be completed August 1956. Plans 10 miles of 10-in. and 10 miles of 8-in. from Grand Island to Albion, Neb., to be completed November 1956. Plans 30 miles of 4-in. laterals to Eckley and Wray, Colo., to be completed July 1956. Seeks FPC permit for 12 miles of 12-in. to replace existing 8-in. between Scott City and Oakley, Kans.

• **Lone Star Gas Co.**—Has two plans before FPC to enlarge system in Texas and Oklahoma: one is a 230-mile line from Cotton County, Oklahoma, to Fritch, Tex.; one is a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. Plans are attempt to keep Natural Gas Pipeline Co. of America from building line from Wise County, Texas, to Fritch.

• **Michigan Consolidated Gas Co.**—Plans 62 miles of 12-10-in. from Muskegon to Ludington, Mich., and 67 miles of 12-10-in. from Lake George to Travers City, Mich., both to be completed July 15, 1956.

• **Michigan Wisconsin Pipe Line Co.**—Has FPC permit for 252 miles of 24, 18, 12, 6, and 4-in. loops in Wisconsin, to be completed November 1956.

• **Midwestern Gas Transmission Co.**—Will build a main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in. Plans 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin, pending FPC approval.

• **Natural Gas Pipeline Co. of America.**—Has FPC approval for 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., which will be contested by Natural Gas Pipeline and Lone Star Gas Co. Filed for FPC permit for a 389-mile, 36-in. loop along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co. Also for 91 miles of 30-in. looping to be laid along parts of its main line. R. H. Fulton & Co. has under way 25 miles of 12-in. laterals and 18 miles of various size gathering lines in Gray and Roberts counties, Texas, to be completed July 14, 1956.

Nevada Natural Gas Co.—Plans loops along its 114-mile line from Needles, Calif., to Las Vegas, Nev.

New York State Natural Gas Corp.—Williams-Austin Co. has 17 miles of 30-in. from Caton to Horseheads, Steuben County, New York, to start July 9, 1956. Harford Brothers has 27 miles of 20-in. from Elk County to Clearfield County, Pennsylvania, to be completed June 15, 1956.

Niagara Mohawk Power Corp.—Let to various contractors, 275 miles of 2 to 12-in. distribution mains for growth of service areas in Central, Eastern, and Northern New York, to be completed December 31, 1956.

• **North Carolina Natural Gas Corp.**—This subsidiary of Colonial Natural Gas Corp. has permit from North Carolina Utilities Commission for 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across North Carolina.

• **Northern Natural Gas Co.**—Applied to FPC to add 348 miles of main line, 307 miles of branch lines in Wisconsin, Minnesota, South Dakota, and Iowa. Main lines include 169 miles in Duluth-Superior area, 164 miles in Aberdeen area of South Dakota. Proposes 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alta., Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

• **Offshore Gathering Corp., Houston.**—Seeks FPC permit for 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in.; 70 miles of 26-in.; 234 miles of 30-in.

• **Pacific Gas & Electric Co.**—Will build 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento. Has under way a 6-mile gathering system at Beehive Bend. Also plans to loop the Topock-Milpitas line with 135 miles of 34-in., laying major part in 1956, and 62 miles in 1957.

• **Pacific Northwest Pipeline Corp.**—Has FPC permit for 37 miles of 6-in. from Dove Creek, Colo., to Nucla, and 13 miles of 4-in. from Nucla to Uravan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America. Contracts let on other trunk and sales laterals:

A. P. V. Co., Inc., 81 miles 26-in. between Plymouth and Goldendale, Wash.

Engineers Limited, Inc., 56 miles 26-in. between Goldendale and Stevenson, Wash.

Midwestern Constructors, Inc., 79 miles of 26-in. from Skamania to Toledo, Wash., to be completed July 1, 1956. M. T. Wilhite, spread man, office at Camas, Wash.

River Construction Corp., 64 miles 26-in. between Toledo and Tacoma, to be completed August 1, 1956, Vernon Gayhart, spread man, office at Vancouver, Wash.; also 16 miles of 18-in. out of Portland, Ore., completed.

B & M Construction Co., 53 miles 26-in. between Tacoma and Duvall, Wash.

Curtis Construction Co., 87 miles 26-in. between Duvall and Sumas, Wash.

Pipeline Patrol

Hood Construction Co., 31 miles 6-in. near Walla Walla, Wash.

R. H. Fulton & Co., 156 miles 20 and 16-in. lateral from main line to Spokane; also 129 miles of laterals into Idaho.

Eastern Pipeline Contractors, 137 miles of 6, 8, 10-in. laterals from Plymouth to Wenatchee, Wash., to be completed July 1, 1956, L. Visentine, spread superintendent, office at Yakima.

• **Permian Basin Pipeline Co.**—Has FPC permit for 19 miles of 16-in. in Andrews County, Texas.

Phillips Petroleum Co.—Vaughn & Taylor has 135 miles of 20 to 2-in. gathering line in Central Oklahoma, to be completed June 1, 1956, and, with McVean & Barlow, 325 miles of 24 to 2-in. gathering line in West Texas, to be completed July 1, 1956.

Portland Gas & Coke Co.—United Engineers & Constructors, Inc., of Philadelphia, has engineering contract for 80 miles of various size lines up to 16-in.

Signal Oil & Gas Co.—C. P. Bartley & Son has 70 miles of 2 to 16-in. gathering system near Tioga, N. D., to be completed September 1, 1956. C. P. Bartley, Jr., and Lawrence Barto, spread men, office at Tioga.

• **Southern California Gas Co. and Southern Counties Gas Co. of California**—Plan three jobs: 19 miles of 30-in. from Placentia to Compton, Calif., to be completed November 1956; 70 miles of 30-in. from Palmdale to Alhambra, Calif., to be completed November 1956; 210 miles of 30-in. from Topock to Palmdale, to be completed April 1957.

• **Southern Natural Gas Co.**—Has temporary FPC authority for 39 miles of loops near Atlanta, Ga.

• **Tennessee Gas Transmission Co.**—Projects:

192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., 110 miles of 4, 6, 8, 10, and 12-in. laterals to extend gathering system from west of Crowley, La., to tie in to Tennessee Gas gathering line, eastward across southeast Louisiana, to mouth of Mississippi River, with laterals extending into Gulf of Mexico.

Contracts let: Houston Contracting Co. has completed 75 miles of 24-in. in southern Louisiana; and has 60 miles of 8, 10, 12-in. laterals south of Morgan City, to be completed June 15, spread superintendent, M. L. Thompson.

Williams Brothers Co. has 55-mile, 24-in. marine job from Cocodrie, La., east of Bay Chalon area, spread man, W. A. Briley.

Grayco Constructors, Inc., Sharman, Allen, Gay & Taylor (formerly Associated Pipe Line Contractors, Inc.), and Collins Construction Co. have remainder.

Has FPC permit for 74 miles of 30-in. looping from Cave City to Danville, Ky., and for 147 miles of 26-in. looping from east of New Boston, Ohio, and north of Ohio River to McConnellsville, and from Newcomerstown to Lisbon, Ohio, both to be completed fall of 1956.

H. C. Price Co. has 82 miles of 26-in., G. A. Reutzel, spread superintendent, office at Chauncey, Ohio.

Applied for FPC permit for 63 miles of 30-in. looping from Scottsville, Ky., to Cave City, and from southwest of Danville to northeast of Danville; for 99 miles of 26-in. looping from Greenup, Ky., to north of Ohio River, from McConnellsville to Newcomerstown, and from Lisbon, Ohio, to near Mercer, Pa.; for 100 miles of 4, 6, 8, 10, and 12-in. gathering line in Texas-Louisiana Gulf Coast area.

Tennessee Natural Gas Lines, Inc.—Walters & Prater has 9 miles of 12-in. looping including Cumberland River Crossing, Tenn., to be completed July 1, 1956.

Texas Eastern Transmission Co.—Applied to FPC, December 1955, for 422-miles of 30-in. from McAllen to Beaumont, Tex., to move imported Mexican gas. Applied for 530 miles of 30-in. looping from Kosciusko, Miss., to Uniontown, Pa. Will lay 45 miles of 24-in. from Provident City, Tex., to connect in Matagorda County, Texas, to tie the Wilcox Trend Gathering System with the extension from Mexico.

• **Texas Gas Transmission Corp.**—Plans 110-mile, 20-in. from Assumption Parish to near Eunice, La. Will also lay 40 miles of various size pipe along main line from Louisiana to Illinois. Both to be completed December 1956. Plans 53 miles of 30-in. from Chicot, Ark., to Clarksdale, Miss., to be completed September 1, 1956. Plans reconditioning of 21 miles of 18-in. line near Wilmot, Ark., and Clarksdale, Miss., to be completed October 1, 1956. Williams Brothers Co. has 9 miles of 26-in. near Whitesville, Ky., to be completed May 31, 1956.

• **Trans Carolina Pipe Line Corp.**, Commercial Building, Raleigh, N. Car.—Seeks FPC permit for 300-mile system across North and South Carolina, plus 500 miles of laterals.

• **Transcontinental Gas Pipe Line Corp.**—Has applied to FPC to lay 160 miles of 36-in. and 68 miles of 30-in. loops from Louisiana to Pennsylvania., to be completed December 1, 1956.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.—Firm is building a 140-mile, 20 and 22-in. line from Safaniya field to Ras Tanura.

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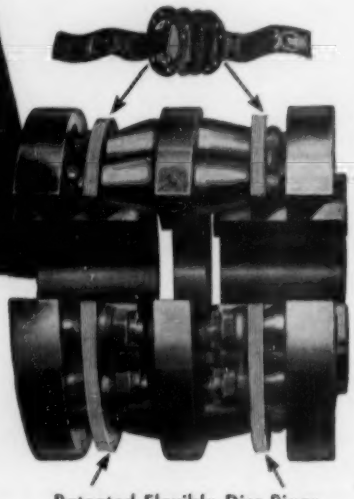

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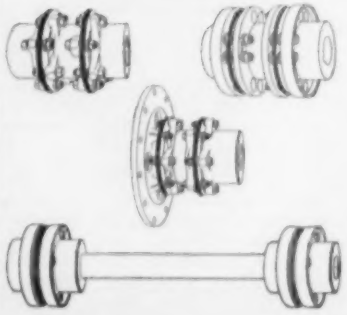

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Pipeline Patrol

• **Canadian Gulf Oil Co.**—Seeks approval for 35 miles of 8-in. to connect Drumhell field, Alberta, with existing Gulf lines running to Edmonton.

• **Cremona Pipe Lines, Ltd.**—Dutton-Williams Brothers, Ltd., has 60-mile, 8-in. line from Sundre-Westward Ho region to Calgary, to be completed July 1956. Company is subsidiary of Home Oil Co.

Creole Petroleum Corp.—Williams Brothers Sudamericano, Ltd., has under way 15 miles of 34-in. from Pueblo Viejo to Lagunillas, Venezuela, to be completed August 1, 1956.

• **Gulf Italia Co.**—Will complete late summer 1956, 35 miles from its Ragusa field in southwestern Siciliy to RASIOM's refinery at Augusta.

Interprovincial Pipe Line Co.—Let to Majestic Contractors, Ltd., 69 miles of looping along present system from Alberta to Sarnia, Ont., to be completed August 31, 1956: 67 miles of 24-in. between Carroll and Somerset, Man.; 2 miles of 26-in. between U. S. border and Gretna pumping station.

Has applied to Board of Transport Commissioners for 150 miles of 20-in., an extension of its line from Sarnia to the Toronto refining area. If approved, work will start spring, 1957, end that fall.

Peace River Oil Pipe Lines, Ltd.—Dutton-Williams Brothers, Ltd., has 35 miles of 8-4-in. gathering system at Sturgeon Lake, Alta., to be completed July 1956, Jack Engleking, spread man, office at Valleyview.

• **Pembina Pipe Line, Ltd.**—Sparling Davis Co., Ltd., has 100 miles of 3 to 10-in. gathering system in Pembina field.

PEMEX.—Constructora El Aguila, S. A., has 50 miles of 20-in. from Angostura to Veracruz, Antonio Sanz Polo, spread man, office at Veracruz.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**—Will build 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.

• **South Saskatchewn Pipe Line Co.**—Plans 58 miles of 12-in. from Cantaur field to Dollard field in Saskatchewan, to start in July, end September 1956.

Westspur Pipe Line Co.—Majestic Contractors, Ltd., has 109 miles of 12-in. from Midale, Sask., to Interprovincial Pipe Line Co.'s pump station at Cromer, Man., and 50 miles of various size gathering lines in Midale-Frobisher area.

Yacimientos Petroliferos Fiscales (Argentina).—Has started 700 miles of 12-in. from Campo Duran to San Lorenzo. TECHINT, (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 160 miles of 10-in. and 43 miles of 8-in. from Sicasica to Arica on the Chilean coast, to be completed December 1957.

Foreign Products Pipelines

• **Canadian Hydrocarbons, Ltd., Winnipeg**—Proposes 800-mile LPG line from Edmonton, Alta., to Winnipeg.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 6 miles of 14-in. from the Capuava Refinery to Utinga Terminal, to be completed December 1956.

• **Imperial Oil, Ltd.**—Will lay 38 miles of 12-in. loop along present line from Waterdown, Ont., to Toronto.

• **Iraq Petroleum Co., Ltd.**—Plans 75 miles of 24-in., 180,000-bbl. daily capacity, from Homs, Syria, to Tripoli, Lebanon.

National Iranian Oil Co.—Contracts let on 573 miles of 10-in., 40,000-bbl. daily capacity, from Ahwaz to Teheran, Iran; Constain-John Brown, Ltd., London, and Williams Brothers Co., started February 1956, laying southern 337 miles; Enterpose of Paris, has northern 236 miles.

• **North Atlantic Treaty Organization (NATO).**—Laying 2,000 miles of lines to airfields in parts of Europe. Sharman, Allen, Gay & Taylor, Inc. (formerly Associated Pipeline Contractors, Inc.), has 450 miles from Iskenderun, Turkey, to Batman. TECHINT (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956, on 300 miles of 12-in. between Marseille and Langres, France.

PEMEX.—Constructora El Aguila, S. A., has 155 miles of 12-in. from Tampico to Cd. Victoria, Geronimo Aviuchastegui, spread man, office at Tampico.

The United States Defense Department.—Sponsoring 485 miles of 8, 10, 12-in. from Cadiz to Zaragoza, Spain. Contracts let to Merritt Chapman & Scott; Benson & Montin of Oklahoma City; Agroman Construction Co. of Spain. Prime contractor is Brown-Raymond-Walsh.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 190 miles of 4-in. from Camiri to Santa Cruz, to be completed December 1956.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co.**—Plans 547 miles of gathering system for the Trans-Canada line: 219 miles, to be completed in 1956, near Saskatchewan and including Pincher Junction, Provost, Bindloss, Sibbald, Oyen, Sunnynook, Steveville, and Cessford; 328 miles, to be completed in 1957, will include Countess, Duchess, Princess, Homglen-Rimbey, and Nevis.

Andes Pipeline Corp.—This subsidiary of Glenn McCarthy, Inc., will build and operate 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper mining area.

Attock Oil Co.—Plans 60 miles from Dhulian field to Rawalpindi in West Pakistan.

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Cía. Shell de Venezuela.—Plans 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces. To be completed in 1957.

• **Empresa Nacional del Petroleo.**—80 miles, 10-in., planned, Concon to Santiago, Chile.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 16 miles of 6-in. from Cubatao refinery to Elcloro plant, to be completed December 1956.

• **Gas Industrial de Monterrey.**—Plans 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Imperial Oil, Ltd.—Has let 65 miles of 4 to 16-in. gathering system in Redwater area of Alta., to Majestic Contractors, Ltd.

• **Magna Pipeline Co.**—Plans to complete fall 1956, an underwater line from Anacortes or Bellingham, Wash., to Victoria.

Mid-Western Industrial Pipe Lines, Ltd.—Dutton-Williams Brothers, Ltd., has 33 miles of 10-in. from Alexander Indian Reservation to Lake Wabamun, to be completed June 1956, L. A. Stewart, spread man, office at Edson, Alta.

North Canadian Oils, Ltd.—Dutton-Williams Brothers, Ltd., has 136 miles of 10-in. from Lake Wabumun to Hinton, Alta., to be completed September 1956, L. A. Stewart, spread man, office at Edson, Alta. Crossings of the McCleod River, Pembina River, and Wolf Creek are being made early.

• **Saskatchewan Power Corp.**—Plans 224 miles in Saskatchewan, to be completed September 1, 1956: 120 miles of 12-in. from Success to Moose Jaw; 57 miles of 8 and 6-in. from Biggar to North Battleford; 30 miles of 6-in. from Dana to Humboldt; 17 miles of 10-in. from Coleville to Hoosier. Letting contracts began May 1.

South Alberta Pipe Line, Ltd.—Filed permit for 150 miles of 8-in. from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta.

Sui Gas Transmission Co.—Pakistan Constructors, a joint company of Morrison-Knudsen of Boise, Ida., and William Press, Ltd., of London, have 188 miles of 16-in. from Sui gas field to Moultan, Pakistan. Work begins mid-1956. Line to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**—Proposes a 321-km., 26-in. line from Anaco to La Mariposa near Caracas.

• **Trans-Canada Pipe Lines, Ltd.**—Time limit to complete financing a 2,250-mile line from Alberta to Toronto and Montreal, is extended to November 1, 1956. New deadline for exporting gas from Alberta is December 31, 1957. Ontario government will help finance line through its province. Tennessee Gas Transmission Co. has proposed a line to take the gas at Emerson, Man. (See Midwestern Gas Transmission Co).

Union of Soviet Socialist Republic.—Has completed 200 miles (between Stavropol and Rostov) of a 900-mile, 26-in. line from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Westcoast Transmission Co., Ltd.—Has let 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash. Dutton-Williams Brothers, Ltd., has 120 miles from Taylor, B. C., to Azouzetta Lake, to be completed August 1957, E. J. Roth, spread man, office at Dawson Creek, B. C. Mannix, Ltd., Canadian Bechtel, Ltd., and R. A. Conyes Construction Co. have remainder, to be completed September 1957.

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Drilling Contractors

Bullard Drilling Co., Inc., Houston, is making hole on a new contract it has with Warren Petroleum Corp. in the South Crowley area, Acadia Parish, Louisiana Gulf Coast. Its test, 1 Sarver heirs and others, in 35-10s-1e, is expected to be carried to 15,000 ft. It is a wildcat.

D & M Drilling Co., Great Bend, Kans., is drilling for Davidor & Davidor, of Oklahoma City, at a wildcat location in western Kiowa County, southwestern Kansas. It is an Arbuckle test with location at 1 Sherer, in 23-28s-20w. Location is west of Mullinville, near the Ford County line. It is about 1½ miles northeast of Helmers field.

Meredith & Co., Houston, has contracted for a 10,250-ft. wildcat test 2 miles north of Kinder field, in Allen Parish, South Louisiana. It will be drilled for Hankamer Investment Co., also of Houston, at 1-A Powell, in 11-6s-5w. Location is about 2 miles northwest of Lyles.

J & B Drilling Co. will drill an 8,000-ft. test for Calvert & Manley, of Corpus Christi, Tex., at a wildcat location 12 miles southeast of DeRidder, in eastern Beauregard Parish, southwestern Louisiana. Location, at 1 Harper, in 5-4s-7w, is about 3 miles northeast of the one-well East Tula field, and 5 miles northeast of the Sweetville area.

C. A. Bell (left, holding Bull pup), tool pusher, and C. A. Funk, driller, on the floor of a rig Nuckolls-Bell Drilling Co., Oklahoma City, is operating under contract in new Bartlesville sand development on the east side of the old Edmond field, west of Edmond, in Oklahoma County, Oklahoma. Drilling is to depths of 6,200 to 6,300 ft.

Clyde Hall Drilling Co., Bakersfield, Calif., has contracted for another deep exploratory test Union Oil Co. will drill in Mountain View field, southeast of Bakersfield, in Kern County, California. The new operation is at 45X-30, in 30-30-29. Union's objective, about 10,000 ft. is the potentially productive Vedder sand. Three previous deep tests, drilled last year, were unsuccessful.

Boyd Durst Drilling Co. is contractor on L. G. Shelly's new 8,500-ft. test 2 miles southeast of Taft, in San Patricio County, South Texas. Location is listed as 1 Locke, in Taft Farm Lands, Gregory Farm Block 8.

Fitzpatrick Drilling Co., Corpus Christi, Tex., is drilling on a new 8,500-ft. wildcat operation 15 miles west of Rachal, in Brooks County, South Texas. It is a contract job for Forest Oil Corp. at 1 Mestena, in Las Mestenas Ysidro Garcia Grant.

J. M. Thomson Drilling Co., Denver, has a new wildcat operation scheduled for Trans-Continental Oil Co. and Gulf Oil Corp. in Washington County, northeastern Colorado. It is a Dakota test at 1 Marble, in 17-1n-54w, 2 miles east of Boots Hill field.

Edwards Drilling Co., Houston, has a new operation contracted for California Co. in the new North Lockport gas-condensate field, southwest of Lake Charles, Calcasieu Parish. It is California Co.'s second test in the area, where Quintana Petroleum Co. has completed four gas wells, all shut in ungaged, from three Hackberry sands from 9,200 to 9,600 ft. The new test, 1 Kearney Heirs Unit 1, is contracted to 10,000 ft. The new area is a mile north of the old Lockport field.

J. D. Sprecher Drilling Co., Casper, Wyo., has contracted for a 9,000-ft. Winnipeg test to be drilled for Ohio Oil Co. at a rank wildcat location in northeastern Harding County, in the northeast corner of South Dakota. Lo-

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cation, at 1 Evenson, in 28-21s-1e, is about 25 miles northwest of Buffalo, and 2 miles from Montana's Carter County line.

Como Drilling Co., Lafayette, La., is under contract to J. Paul Ratliff, Jr., of Pass Christian, Miss., for a 7,000-ft. test on the west flank of Napoleonville dome, in Assumption Parish, Louisiana Gulf Coast. The test is on the Labarre lease, in 40-12s-13e.

Milam Drilling Co., San Antonio, is drilling for Holland Oil Co. at a wildcat location, 1 Dunkin, in A. Harrison Survey 2, 4 miles southeast of Schattel, in northeastern Frio County, Southwest Texas. Its operation is a 4,700-ft. Navarro test. Location is near the Atascosa County line.

Zach Brooks Drilling Co., El Dorado, Ark., has a rig working for Murphy Corp., also of Shreveport, at a wildcat location in the Mill Creek area, 4 miles southeast of Catesville field, in southern Union County, Arkansas. Contract calls for a Smackover test with objective at 7,900 ft. The test is Murphy 1 Williams, in 12-19s-15w.

Jack Halbert is contractor on a wildcat operation George Williamson, Jr., of Jacksonville, Tex., is starting 1½ miles southeast of Turney, in Cherokee County, East Texas. It is a 5,000-ft. Woodbine test at 1 Jones, in the J. D. Leathers Survey.

Big Chief Drilling Co., Oklahoma City, soon will have a rig working for Phillips Petroleum Co. in the area of the latter's recently opened Eugene Island Block 184 field in the Gulf of Mexico, 45 miles off the coast of St. Mary Parish, Louisiana. It will drill Phillips' 1-B (Dome B) OCS-O471, a wildcat located in Block 172, about 8,800 ft. north and 2,900 ft. west of the discovery well. The discovery well, completed last March as a gas-condensate producer in a 14,800-ft. sand, was drilled with a company-owned rig, now on its second hole.

Great Western Drilling Co., Midland, Tex., will move a large rig to San Pete County, in Central Utah, where it will drill another well for Three States Natural Gas Co. in the Joe's Valley area, in the eastern part of the county. The new test, 3 Joe's Valley, in 20-15s-6e, will be a mile southeast of a shut-in gas-discovery well (1-X Joe's Valley) completed last year. The discovery well tested at rates up to 15,000,000 cu. ft. of gas daily from Ferron sand at a total depth of 7,262 ft. The confirmation test is scheduled to go to 8,100 ft.

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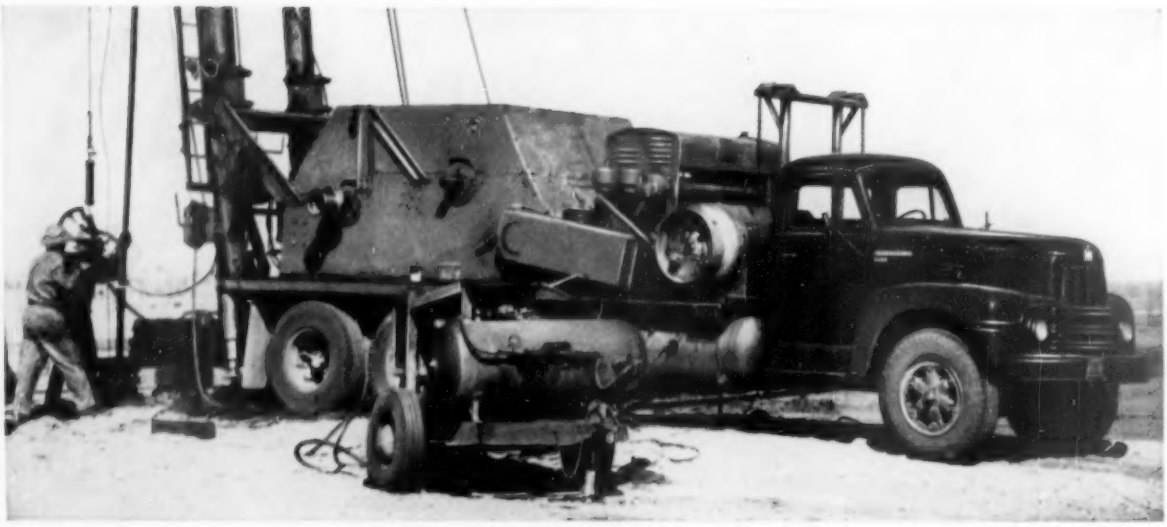

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Showcase

OF NEW EQUIPMENT AND LITERATURE

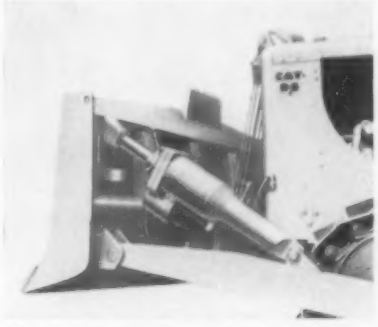
by Dan B. Miller

Attachment Tilts Blade of Bulldozer for Ditching

A new hydraulically actuated bulldozer tilting attachment is designed to give D8 and D9 tractors increased versatility on such jobs as ditching, pioneering roads on hillsides, digging rocks, and other applications which require frequent tilting of the blade.

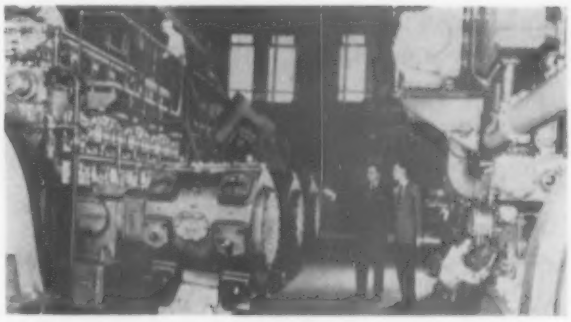
Heart of the new tilting attachment is a large, hydraulic cylinder which replaces the left bulldozer blade brace. With the right-hand brace adjusted to its neutral position, either corner of the No. 9S blade can be raised approximately 28 in. above ground level by retracting or extending the tilt cylinder. On the No. 8S, this figure is approximately 24 in.

Additional tilt can be obtained by extending or retracting the screw-type right-hand brace. New bulldozer trunnions, designed to take full advantage



of the maximum available tilt, are furnished with all new 9S and 8S bulldozers.

The tilt cylinder is controlled from the operator's seat by means of a front-mounted No. 44 hydraulic control or the new rear-mounted No. 48 hydraulic control. The No. 48 control has an output of 42 g.p.m. at 1,412 r.p.m. at 1,000 psi. The hydraulic pump is mounted on and driven by the engine rear power takeoff, and the control valve is enclosed in the tank which is mounted separately on the rear of the tractor. **For more information write or call: Caterpillar Tractor Co., Peoria, Ill.**



Uniflow Has Independent Turbocharger

A new gas-engine compressor, available in 750-2,500-hp. range, is the only two-cycle spark-ignition gas-engine compressor that operates with a completely independent exhaust gas-driven turbocharger.

Operating at relatively high compression ratio, the SUTC Turbo-Uniflo has smooth combustion characteristics. The new design results in quieter operation, low fuel and lube-oil consumption, and low b.m.e.p., i.e., 96.1 psi. at rated speed and load. A complete absence of residual gases in the combustion chamber results in high turbocharging-scavenge ratio.

The SUTC is designed for pipeline transmission service; in natural gasoline plants; for pressure maintenance flows; for oil-refinery operations; recycling and stabilization of gases; and for refrigeration systems in the processing industry.

The SUTC engine gives high thermal efficiencies. Exhaust-gas energy normally wasted on two-cycle engines with

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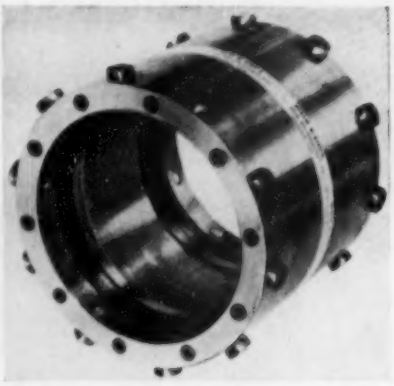
mechanically driven scavengers is recovered by the completely independent exhaust gas-powered turbocharger. This supplies varying amounts of scavenging air, exactly matching air-gas fuel ratio proportions throughout the entire range of speeds and loads required.

Because power is no longer required for a positive displacement scavenging air source, more power is put to work in the engine compressor cylinders. **For more information write or call: Worthington Corp., Harrison, N. J.**



Couplings Made for Use on Hot Process Pipelines

A newly developed, high-temperature-resistant packing ring permits these couplings to be used on high-temperature pipelines.

The packing rings are made of an asbestos - mica compound. They are molded into the coupling at the factory and are shipped out ready for installation.

These asbestos - mica packing rigs have been tested to pressures of 1,500 psi. at 1,000° F. on oily steam pressure. Pressure-temperature applications may be determined by the ratings of the standard codes for mild carbon-steel pipe. Special couplings of carbon-molybdenum or chromium - molybdenum steels where higher pressure-temperature ratings are required can be supplied on order.

Hot oil, hot asphalt, steam, and other hot-process pipelines can now be rejoined and welded while on stream at high temperatures by using these couplings. **For more information write or call: The Pipe Line Development Co., 5700 Detroit Avenue, Cleveland 2, Ohio.**

Variable-Speed Motor Is Designed for Low Speeds

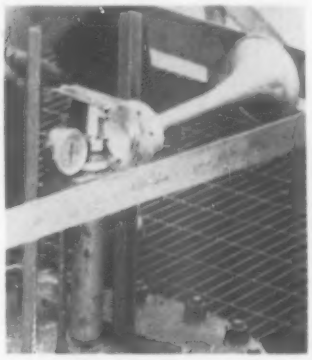
A new variable - speed, internally geared Varidrive motor has a take-off shaft and motor on the same side. The new motor is ideal for low-speed applications requiring variable speed, where weight distribution and limited space is a factor. Designated Type VEV-1-GD (double reduction) and type VEV-1-GM (triple reduction), the new units are available up through 5 hp. Both upright and horizontal assemblies are on production with either dripproof, totally enclosed or explosionproof motors. These Varidrives provide very slow speeds and high torque, without

resorting to the use of separate gear boxes, speed changers, extra couplings, guards, and other extraneous material.

Castings are heat treated to remove internal stresses and prevent distortion. The system of lubrication provides a large volume of grease surrounding the bearings, and relubrication without disassembling the unit. Windings are asbestos protected to resist burnout. The one-piece, double-ribbed Varibelt transmits power smoothly and absorbs shock loads and vibration. **For more information write or call: U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif.**

Signal Horn Sounds When Storage Tank Is Full

A new self-powered automatic signal horn designed to alert plant crews against overflow of petroleum, chemical, and petrochemical tanks during filling operations is known as the Falcon tank-overflow horn. The new float-activated unit can be heard more than 1,000 ft. away. The device, designed for installation on top of bulk-storage tanks, can be powered by harmless carbon dioxide, Freon 12, nitrogen, or compressed air and will sound a sharp 2 to 4-minute warning to pumping crews.



The unit consists of a 2-in.-diameter steel cylinder of compressed gas about 12 in. long, pressure gage, horn assembly, and float-operated valve assembly. When liquid level in the tank nears the safe-filling limit, the float activates mechanical linkage to the horn unit and starts the warning. **For more information write or call: Falcon Alarm Co., Inc., Summit, N. J.**

●

Centrifugal Pump Handles Wide Range of Capacities

A new centrifugal pump known as the Model BL provides high efficiency over a broad range of service conditions. Each size of the Model BL handles a wider than usual range of pressures and capacities and each will accommodate fluctuations in either pressure or capacity without serious loss of efficiency.

The Model BL centrifugal pump is available in five sizes of 2, 3, 4, 5, and 6 in. Each size is designed with heavy-duty ball bearings, factory lubricated to minimize lubrication troubles. Each size has an extra large shaft to maintain perfect alignment and a strong supporting frame. A trouble-free mechan-

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in low pressure permeable zones

Many formations need the protection provided by Larkin Cementrol . . . and many thousands of wells are better producers because of this Cementrol protection. The Cementrol packing element, expanded by pump pressure from the surface, prevents cement from coming into contact with exposed producing formations beneath the casing seat. Cementing is accomplished through ports above the packing element which are not exposed until the element is expanded. Originated by Larkin, Cementrol Equipment has been used successfully in thousands of wells. Let Cementrol help you get cleaner completion in low pressure permeable zones. Available through your supply store.

● Cementrol is available as a collar for setting at any point in the casing string. Cementrol shoes and collars are also furnished with the built-in flapper valve which makes unnecessary the use of a flapper float collar at some point above the shoe.

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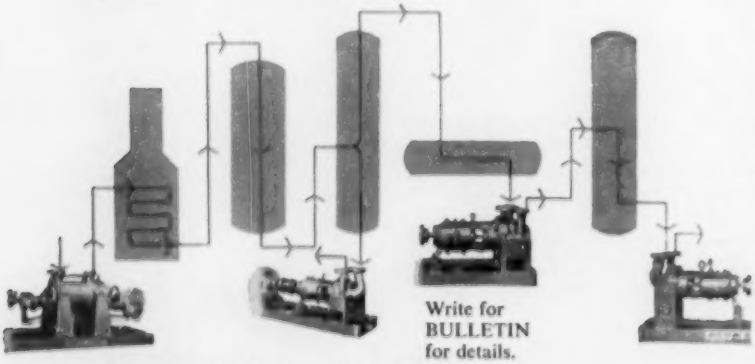

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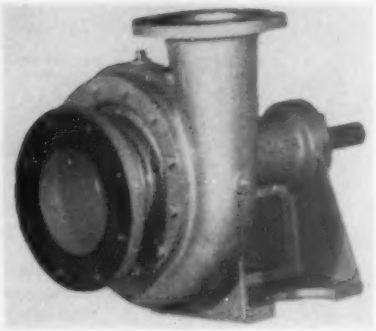


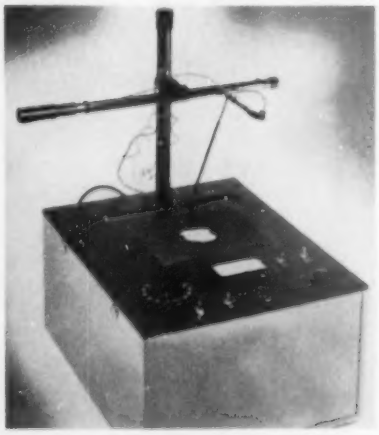
ical seal replaces the stuffing box. **For more information write or call: Gardner-Denver Co., South Front Street, Quincy, Ill.**

•

Gravity Anomaly Simulator Shortens Data Work

The gravity anomaly simulator is a new instrument that simulates the effect on the earth's gravity field of a subsurface body of anomalous density. This compact instrument will be of value in interpreting data obtained when prospecting for petroleum with gravity meters.

With the new gravity anomaly simulator, it is possible to prepare gravity data in hours that would require days



by previous calculating methods. The instrument, measuring 24 by 19 by 31 in. and weighing 24½ lb., can be operated on an ordinary office desk.

The anomaly simulator has two basic applications which are highly useful in the processing of gravity data: (1) starting with a possible subsurface

*ROLOCHECK OIL WELL METERS

assure greater accuracy and less maintenance

IN MEASURING CRUDE OIL OR SALT WATER

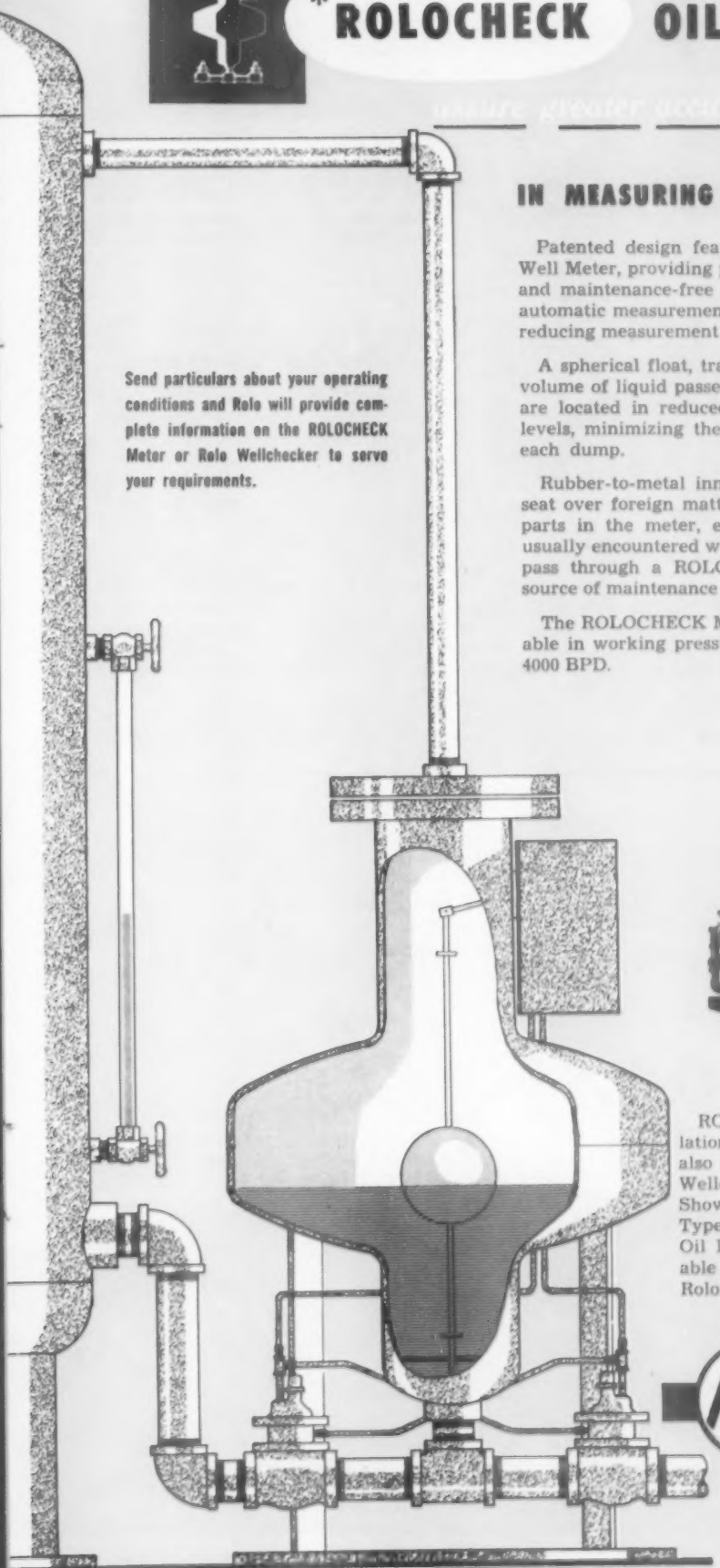
Patented design features of the simplified ROLOCHECK Oil Well Meter, providing positive dumps, positive liquid-level control and maintenance-free operation, assure greater dependability of automatic measurement of crude at the separator on the lease . . . reducing measurement costs . . . increasing profits.

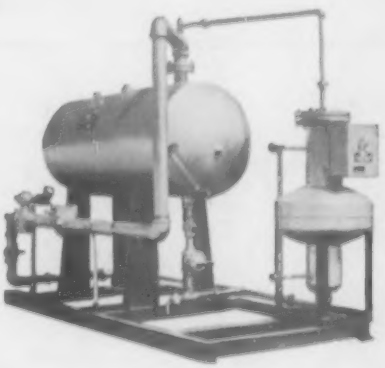
A spherical float, traveling between positive stops, controls the volume of liquid passed per cycle. The liquid level control points are located in reduced-diameter necks at the upper and lower levels, minimizing the margin of possible measurement error in each dump.

Rubber-to-metal inner valves in the dump valves, which will seat over foreign matter, and the lack of close-clearance moving parts in the meter, eliminate expensive maintenance problems usually encountered with old style oil meters. Also, free gas cannot pass through a ROLOCHECK Meter, thus eliminating another source of maintenance worries.

The ROLOCHECK Meter has a zero minimum rate, and is available in working pressures from 150 to 1440 psi and capacities to 4000 BPD.

Send particulars about your operating conditions and Rolo will provide complete information on the ROLOCHECK Meter or Rolo Wellchecker to serve your requirements.





ROLOCHECK Meters are available for installation on existing separators or treaters, and are also now standard equipment on complete Rolo Wellcheckers, either skid- or trailer-mounted. Shown above is a skid-mounted Wellchecker, Type 4-1H-3006-24, employing a ROLOCHECK Oil Meter. These compact units are also available with Automatic Free-Water Knockout and Rolo Automatic Sampler.

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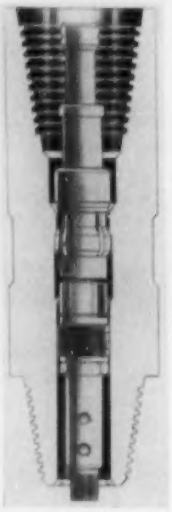
body, the gravity anomaly that it would produce may be calculated; and (2) having measured a gravity anomaly, subsurface bodies that may produce such an anomaly may be simulated.

The gravity anomaly simulator utilizes the principle of Lambert's cosine O law. Mathematically, it may be shown that the light integral for a horizontal layer has the same form as the gravitational integral for the same layer. By suitably scaling down all dimensions of the gravitational layer, a luminous surface of the same shape can be formed, allowing the integration to be performed by simply measuring the illumination.

In the HTL anomaly simulator, an opaque slide of paper having a cut-out opening in the outline of the desired body is placed over a light source. The light reading is shown on a meter and combined with a multiplicative factor in determining the gravitational anomaly. **For more information write or call: Houston Technical Laboratories, 2424 Branard Street, Houston 6, Tex.**

Nipple Gives Quick Means Of Plugging Drill Pipe



A new drill-pipe nipple and removable plug provides a quick, safe means of plugging drill pipe if a well begins to unload during drilling or workover operations. The equipment consists of a nipple built on drill-pipe dimensions and a removable plug choke which seals off in the polished bore of the nipple.

The equipment can be used in three different ways to plug the drill stem in case of a threatened blowout. If there is a possibility that the well might unload as pipe is being run, the nipple can be installed in the string near the bottom with the plug in place to allow flow downward through the drill stem.

The nipple may also be run in as part of the string when pipe is tripped, and, if the well comes in, a gate valve can be stabbed onto the joint at the surface and the plug pumped down into the nipple, or the nipple and the gate valve can be stabbed onto the joint in the rotary, the plug pumped in, and the string run to bottom. The plug can be retrieved on a wire line, under pressure, as desired. **For more information write or call: Otis Pressure Control, Inc., P. O. Box 7206, Dallas, Tex.**

●

Base Station Designed For Desk-Top Convenience

A new desk-top model base station features finger-tip control without using control lines. The new unit, known as Model MCA-155-B desk-top console base station, is a complete base station for desk-top mounting and is designed to meet requirements of dispatchers, foremen, and the like, to provide the complete facilities of a two-day mobile radio base station with the convenience and reliability of a desk telephone. A front-panel meter checks complete performance. Using the most modern circuitry and design, the MCA-155-B combines high performance and accessibility in a compact, attractive unit. The equipment

▼for acidizing or fracturing...
the toughest blocking agent is
Formjel

complement includes preamplifier, built-in loudspeaker, desk-type microphone, and built-in multimeter.

The new unit's specifications are: 8½ in. high; 23½ in. wide; 18 in. deep, weight about 50 lb. It comes with a full line of accessories including digital clock, dual-frequency transmitter and/or receiver, and foot switch.

The frequency range of the MCA-155-B is a 25-54 mc., 40 watts minimum output. The same type base station is also available for 144-174 mc. as the MCA-355-B and 450-470 mc. as the MCA-455-B. **For more information write or call: Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Avenue, Clifton, N. J.**

●

Field Jointer Is Put on Easily and Economically

A new and practical field jointer is designed for economy and for saving time during application, as well as ease in application. This field jointer's advantages include the following. It is adapted for either hot dope or concrete coatings; it costs less than the conventional metal forms; it is shipped as a complete package unit; it is lighter in weight; all sealing and gasketing material is attached. In actual use no leak-

age is found where the felt gasket seals each edge of the jointer; the bottom of the jointer stays rigid, permitting no sag.

The field jointer is manufactured of flexible hardwood plywood, bonded between two layers of heavy kraft. It is available in any width or length in sizes to suit any requirement. **For more information write or call: Greenhead Sling & Supply Co., 3912 Leeland, Houston, Tex.**

New Drill Line Provides 15 Per Cent Extra Strength

An extra-high-strength grade of flattened strand wire rope is 15 per cent stronger than previously offered. This stronger grade will be called Porter Imperial Red-Strand wire rope, and all ropes of this quality will be fabricated with steel cores.

The additional strength has a number of advantages. Greater than normal temporary loads can be handled without having to install a larger rope with the accompanying trouble and expense of new sheaves and other possible equipment changes. It is sometimes possible to do a safe and satisfactory job with a smaller-diameter rope than would otherwise be needed. The extra-high-quality steel and the controlled manufacturing methods by which it is made give Imperial Red-Strand wire rope high resistance to fatigue, abrasion, crushing, and shock.

This new grade of wire rope is well suited for the drilling industry where wells are being drilled deeper and the load of the pipe string is large. **For more information write or call: Leschen Wire Rope Division, H. K. Porter Co., Inc., 2727 Hamilton Avenue, St. Louis 12, Mo.**

Successful treatment in either limestone or sandstone formations frequently depends upon effective blocking. *Formjel* is a temporary sealing or blocking material we use to control acidizing and hydraulic fracturing treatments. It is compounded with kerosene, a jelling agent, a breaker, and a filler. It has excellent viscosity, A.P.I. fluid loss is zero, the weight may be varied, and the material is formulated so that it will break out completely within 10 to 24 hours. The widespread success of Formjel in thousands of wells has established it as the toughest blocking agent in the oil field today.

Using The Chemical Process Company Permeter Control Tools, a slug of Formjel can be spotted to block an upper zone while the lower zone is being treated (and vice versa), to block channeling behind casing set through pay zones, to seal leaking packers or block the formation above or below a packer against vertical communication, or to achieve multiple zone penetration.

Two companion blocking agents are also available for special well conditions: *Thermogel*, for wells with high bottom hole temperatures, has excellent stability and maintains its viscosity during prolonged treatment of deep wells. *Firmjel*, a special, permanent-type seal, is designed for correcting gas-oil ratios by sealing the gas pay above a packer. We have used both of these agents successfully in hundreds of wells.

If you are encountering unusual engineering problems in acidizing or fracturing your wells, contact your nearest Chemical Process Company station for more information about these and other special CPC well stimulation procedures. There is no obligation, and you will find our representatives anxious to help you any way they can.

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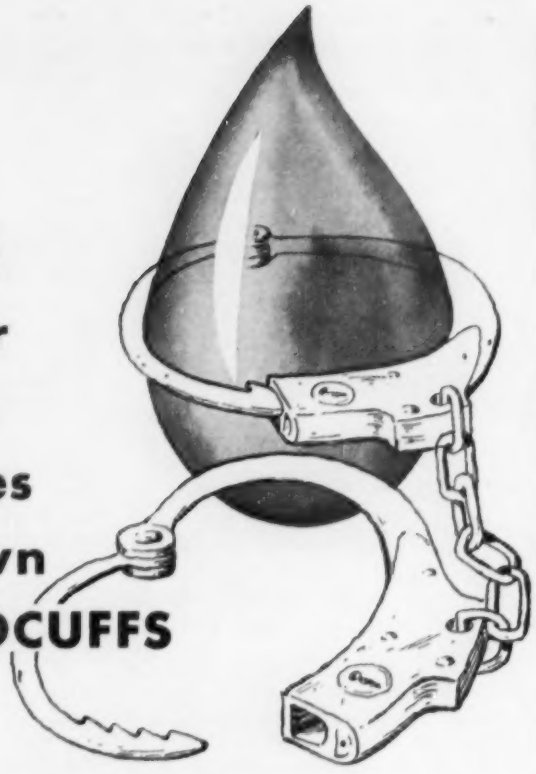
Flood water often carries its own HANDCUFFS



• All too often, flood water takes with it into the earth the means of its own strangulation—the invisible handcuffs which will gradually but surely slow or halt the drive. In nearly every part of the oil country, the experience of many water flood projects proves that this is not theory but crippling fact.

• Settling, sedimentation and conventional filtration only partially remove from the injection water the algae, bacteria (particularly the sulfate-reducing bacteria) and some of the precipitants which have been identified as major causes of formation plugging. But diatomite filtration unlocks the "handcuffs" from injection water, because its "sharp" filtration traps and removes even bacteria and other colloidal solids. The trouble-free experience of many flood projects now using diatomite filtration is convincing evidence of its effectiveness, particularly in the cases where diatomite-filtration flood projects are operating close to other projects which use conventional clarification methods and whose injection pressures continue to rise, month after month.

• Other advantages of diatomite filtration are the smaller space requirements (about 1/5 that of sand filter systems), the lower installation costs, and the mobility of diatomite systems, some of which are completely unitized.

For more complete information, write

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OIL AND GAS JOURNAL Showcase

- BULLETINS
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Multicell Filters. Industrial water-conditioning filters are the subject of a four-page, four-color leaflet. Bulletin 5624 gives information on installation, backwashing, filter media, and piping. Diagrams show the different methods of backwash and installation. **For more information write or call: General Filter Co., Ames, Iowa.**

•

Glassed Steel for Acid Solutions. A 12-page, 3-color booklet, Bulletin 928, gives information useful in the choice of material to be used in construction of equipment for the chemical-processing industries. Such factors as the influence of temperature, concentration, and corrosion are discussed. Five colored charts are given showing corrosion resistance of glass coatings. **For more information write or call: The Pfaudler Co., Rochester 3, N. Y.**

•

Askania Powerpack Regulator. Bulletin 165 describes the applicability, operation, and features of the Powerpack regulator which develops a powerful correcting action in response to a wide range of control signals. This four-page bulletin describes features of operation for the unit when used for such applications as relief and reducing-valve operations, liquid level, feed-water pumps, steam-pressure reducing stations for pressure control, flow control, and antisurge governor for blower installations. The unit is used in connection with butterfly or lever-actuated valves. **For more information write or call: Askania Regulator Co., 240 East Ontario Street, Chicago 11, Ill.**

•

Condenser Tube Alloys, a 44-page manual, assists engineers in the selection of condenser tube alloys. The booklet discusses the application and installation of condenser and heat-exchanger tubes and plates for tube sheets, heads, and baffles. The facts set forth in Publication B-2 are especially for engineers responsible for the selection of material in oil-refinery and field-processing industries. Detailed information, based on actual installations as well as lab-

oratory tests, is presented. **For more information write or call: The American Brass Co., Waterbury 20, Conn.**

●

Inert Gas Generators. In addition to detailed drawings, photographs, and capacity and dimension tables, Bulletin IGG-155 contains a useful information sheet. Ample space is provided for an analysis of the work to be done by the inert gas generators, operating conditions, utilities needed and other data necessary for proper selection of type and size of unit. **For more information write or call: Roots-Connersville Blower Division, Connersville, Ind.**

●

Worthington Goodyear V-Belts. This new bulletin contains illustrations of types available for drives employed in heavy industrial applications and miscellaneous light machinery drives. High-tensile steel cables carry the load. Also described in Bulletin V-1400-B20-P are the HY-T belts, the EC cord V-belt, the open-end V-belts, and the Vee-Ply belts (quick detachable V-belt). **For more information write or call: Worthington Corp., Mechanical-Power Transmission Sales Department, Oil City, Pa.**

●

Computer Components contains illustrations, details, and outline specifications of mechanical and electrical components most frequently used in analog and digital computers. **For more information write or call: Librascope, Inc., 808 Western Avenue, Glendale, Calif.**

●

Hills-McCannameter. Bulletin 300 describes the features of the McCannameter which include improved accuracy at small flow rates and a new capsulated liquid end which offers ease of maintenance. Complete capacity tables and a detailed schematic of the McCannameter are also included. **For more information write or call: Hills-McCanna Co., 2443 West Nelson Street, Chicago 18, Ill.**

●

Maintenance-Free Pumps. A new eight-page pump bulletin, Form 7248-A, covers the redesigned line of DMV-DHV single-stage centrifugal pumps. Designed for general hydraulic services, these pumps feature double mechanical shaft seals which eliminate stuffing-box maintenance, and prelubricated, sealed ball bearings. Single mechanical seals are also provided for services where the liquid being handled is clean, and supplied at a positive suction pressure. These horizontally split, single-stage pumps are built in sizes from 3 to 6 in. with heads to 350 ft. and capacities from 250 to 2,400 g.p.m. Also incorporated in this bulletin are typical installation views, cross-sectional views, an exploded view of component parts and dimensions. **For more information write or call: Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.**

●

Double-Suction, Single-Stage Centrifugal Pumps are described and illustrated in a new eight-page bulletin. They are recommended for general service wherever liquids of low viscosity are to be moved. Case is split on horizontal center line, and rotating parts can be removed for maintenance without disturbing piping. Cross-section drawings and construction details for standard sizes up to 10-in. discharge are included in Catalog A-156. **For more information write or call: C. H. Wheeler Manufacturing Co., Nineteenth & Lehigh, Philadelphia 32, Pa.**

●

General-Purpose Emulsifier. Witco 31, a general-purpose, nonionic emulsifier, is described in a new technical bulletin. The material has a high degree of surface activity and disperses readily in water and in many organic solvents. It is an emulsifier for fats, oils, some waxes and similar products generally forming oil-in-water mixtures. It also can be used to incorporate butyl stearate in concrete mixes to provide water repellency. The bulletin gives complete specifications, properties, and packaging information. **For more information write or call: Witco Chemical Co., 122 East Forty-second Street, New York 17, N. Y.**

●

Pfaudler PW Drive. Bulletin 931 covers the operation and maintenance of the PW drive for agitators used in chemical processing. It gives tips on motor installation and maintenance and has a chart on recommended motor horsepower and shows suggested agitator speeds. Operating instructions and lubrication techniques for the PW drive itself also are given. A drive with either a stuffing box or a rotary seal can be disassembled by the individual steps shown in the bulletin. Information and drawings given also indicate the methods for belt alignment and length and for control of speed and load capacity of the variable speed sheaves. **For more information write or call: Pfaudler Co., 1014 West Avenue, Rochester, N. Y.**

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EQUIPMENT MEN . . . in the News

Sivalls Tanks Appoints Jack Gray, Allen Leibee

JACK GRAY

Promotion of Jack Gray to the post of Odessa-Midland branch manager and appointment of Allen Leibee as sales and service representative have been announced by I. W. Lovelady, president of Sivalls Tanks, Inc.

Gray now directs the company's sales and service activities in the Odessa-Midland district. He formerly served as sales and service representative working out of Odessa. He joined Sivalls Tanks 3 years ago.

Leibee has been assigned to the territory of Monahans, Fort Stockton, Wickett, Imperial, Grandfalls, Royalty, Pecos, Mentone, and Orla. He joined Sivalls as a trainee in 1955, following 8 years with Stanolind Oil & Gas Co.

Lane-Wells Names Ohl Kansas District Manager

Charles O. Ohl has been appointed district manager for the Kansas district of Lane-Wells Co., according to Ed Saye, division sales manager. Saye, formerly district manager, has been transferred to Oklahoma City as division sales manager of the Mid-Continent division for Lane-Wells.

Ohl joined Lane-Wells in 1945 in the Oklahoma area. Later service included well-logging operations in the Rocky Mountain area. Prior to his appointment as district manager, Ohl has been for 3½ years district manager of the Illinois district at Olney. Ohl will headquarter at the Great Bend office.

Granberg Appoints O'Brien Chicago Service Engineer

James E. O'Brien has been appointed service engineer for Granberg Corp. of Oakland, Calif., in the Chicago area, according to John Havens, Chicago division manager.

The firm's warehouse facilities will be expanded to stock the complete line of Granco pumps and meters, including rotary positive displacement pumps, meters, and accessories, and centrifugal pumps and accessories.

O'Brien has had 13 years' experience in the meter field and will undergo an intensive factory training course at the Oakland plant.

Buffalo Company Named Burgess-Manning Agents

Bass Industrial Equipment Co., Buffalo, N. Y., has been appointed western and central New York sales representative for Burgess-Manning Co., industrial silencer division, manufacturers of industrial noise-abating and pulsation-damping equipment. S. G. Paddock, Burgess-Manning vice president has announced.

The Buffalo concern, which is headed by Roy A. Bass and Kenneth Bass, is agent for Burgess-Manning exhaust and intake snubbers, gas regulator silencers, pulsation snubbers, and combination air intake cleaner-silencer systems, applied in the industrial, petroleum, and chemical fields.

Hughes Promotes Myers

P. L. MYERS

Promotion of Park L. Myers to assistant general sales manager of Hughes Tool Co. has been announced by M. E. Montrose, vice president, sales. Myers has been sales manager of the North Texas division. He has been with Hughes Tool Co. since 1937, having served in several drilling areas.

Union Switch & Signal Names Dion to Sales Post

Martin L. Dion will assume responsibility for the administration and sales program for pipeline-control equipment according to A. S. Robertson, manager, general apparatus sales, Union Switch & Signal, a division of Westinghouse Air Brake Co.

Dion has had experience as a sales engineer for Bristol Co. and as southwestern district sales manager for The Electric Service Manufacturing Co., the position he held prior to joining Union Switch & Signal.

Welch Manages Dearborn Chemical's Dallas Office

To provide better service to customers in its Southwest market, Dearborn Chemical Co. has established a new district office in Dallas headed by E. M. Welch, southwestern district manager. The office will handle all industrial sales in Texas, Louisiana, Arkansas, Oklahoma, New Mexico, and most of Kansas.

Welch was formerly director of sales engineering in the industrial department of the company's Chicago office. He has been with Dearborn 28 years, with most of his time during the past year being spent as a representative of the company in the Southwest.

Texas Oil Man Takes Delivery on Cessna 310

Receiving the keys to his new Cessna twin-engine Model 310, shown in the background, is Watson La Force (center), independent oil operator of Midland, Tex. The keys are being presented by Wayne Champney of Champ's Aviation, Inc. of Lubbock, Cessna dealer in West Texas. At the right is Eldon Bloyd, Cessna regional sales manager for the Southwest, who was present at the ceremony in Wichita. La Force's Model 310 was the 310th production model off the Cessna assembly line.

Andrews Heads Dresser's General Markets Sales

The appointment of William S. Andrews as manager of general markets sales has been announced by Dresser Manufacturing Division. From his new headquarters in Bradford, Andrews will manage sales of piping products in petroleum and process industries. He will also direct the promotion and sales of products through distribution outlets.

The past 18 years Andrews has spent as a district manager for Rockwell Manufacturing Co. He has also had experience with Remington-Rand, Merco Nordstrom Valve Co., and Beaver Pipe Tools, Inc.

Continental Supply Makes Allen Canadian Store Mgr.

The appointment of Perry J. (Jack) Allen to the position of store manager at its Lloydminister, Alta., Canada, store has been announced by Continental Supply Co.

Allen has been an employe of the oil-field-supply company since 1952 and previously was a buyer in the purchasing department of Continental's home office in Dallas, Tex.

Republic Supply Regroups Stores, Names Managers

Republic Supply Co. is regrouping its stores so that each district manager will have fewer stores in a smaller area and can give faster and more efficient service to customers.

T. P. Nelms is a new district manager with headquarters at Abilene, Tex., and stores at Abilene, San Angelo, Rule, and Snyder, Tex.; R. L. Black, Jr., is another new district manager with headquarters at Borger, Tex., and stores at Borger and Pampa, Tex. Both men have been with Republic 11 years and each has served as store manager, field salesman, and special district sales representative.

Oilwell Moves Smith and Ireland, Appoints Long

Transfer of field representatives Billy E. Smith from Huntington Beach to Long Beach, Calif., and James M. Ireland from Long Beach to Huntington Beach for U. S. Steel's Oil Well Supply Division has been announced by R. K. Baker, manager of the division's Neilson Pump Works. The appointment of Frank J. Long as city representative at Casper, Wyo., has been announced by R. L. Armstrong, Rocky Mountain area manager of the division.

Smith, who has been field representative in Huntington Beach since 1953, has been with Oilwell since 1947. Ireland has been field representative in Long Beach since he joined the firm in 1945. Long joined Oilwell in 1949. He served as field representative at Glendive, Mont., Williston, N. D., and Casper. In 1953 he was appointed store manager at Fort Morgan, Colo.

Research-Development Engineer Named By O-C-T

J. M. LEBEAUX

Dr. J. M. Lebeaux has been named research and development engineer for Oil Center Tool Co., John Maher, president has announced. Lebeaux was formerly employed by Stanolind Oil & Gas Co. Lebeaux's work at O-C-T will include a review and study

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Axelson Names Summers and Rainbolt Factory Agents

H. E. Summers, Jr. and H. M. Rainbolt recently completed field training and have been appointed factory representatives for the petroleum-equipment department of Axelson Manufacturing Co., division of U. S. Industries, Inc. The announcement was made by K. S. Ramey, sales manager of the petroleum-equipment department.

Summers will be located at Kermit, Tex., and Rainbolt in Oklahoma City.

Lane-Wells Opens New Branch in Oklahoma

To serve needs of the southern Osage fields, Lane-Wells Co. has opened a new branch in Hominy, Okla., under the direction of Harley C. Hanselman, it has been announced by J. F. Alexander, Oklahoma district manager. James R. Roberts will also be located at the new branch.

This branch is equipped to provide perforating service and well-logging service on a 24-hour-per-day basis.

W-S Fittings Division Makes Siebert Sales Mgr.

C. J. SIEBERT

Carl J. Siebert has been appointed sales manager of W-S Fittings Division, H. K. Porter Co., Inc., it has been announced by Jackson Kemper, vice president and general manager of Roselle, N. J., plant.

Siebert, who was district manager of the Chicago office prior to his present appointment, has been with the fittings division 4 years. He joined the company in 1952 as sales representative in the Pittsburgh territory.

Prior to joining the division, Siebert was a sales engineer for Pittsburgh Gage & Supply Co. He had also served with the R. P. & C. division of American Chain & Cable Co. and with Westinghouse Corp.

RCA Makes Salladin Sales Representative in East

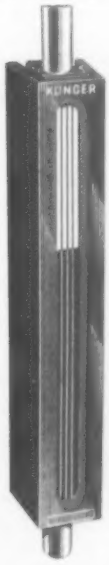
Appointment of John L. Salladin as field sales representative for Radio Corp. of America microwave radio equipment in the eastern region has been announced by R. C. Dubois, sales manager, communications-products department, RCA commercial electronic products.

Salladin assumes the territory formerly assigned to E. J. Hart, who recently was advanced to manager, RCA microwave-equipment sales. He will make his headquarters in RCA's Camden, N. J., offices. For the past 5 years Salladin served as an engineer for RCA communications systems. Prior to joining RCA in 1951, he was a communications engineer for a pipeline company in the Middle East.

Magcobar Transfers Foil, Carlton, and DeBusk

James Carlton has been reassigned to Shreveport, La., as division sales representative for Magnet Cove Barium Corp., Houston; R. B. Foil has been named district manager in Mississippi; and James DeBusk has been appointed division sales representative in California, replacing James Homan, who has resigned. The personnel changes were announced by Frank Loe, sales manager.

Carlton, formerly district manager in Mississippi, has been with Magcobar since 1950. Foil served as a mud engineer with a major oil company until



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1952, when he joined Magcobar. Prior to his recent appointment, he was sales and service engineer in Shreveport. DeBusk has been with Magcobar since 1954. He was sales and service engineer in the Mid-Continent division before his recent appointment.

Clausel Is Administrative Ass't. for Housh Drilling

C. L. CLAUSEL

The appointment of C. L. Clausel as administrative assistant in operations of Housh Drilling Co., Portable Bridge & Equipment Co., Housh oil producing and other enterprises has been announced by Cecil N. Housh and Lester G. Housh, owners.

Clausel organized A-1 Bit Co. in 1932. After purchase of Universal Core Barrel Co. in 1946, the firm changed its name to A-1 Bit & Tool Co., and Clausel was elected president and chairman of the board. He retired as president in 1955. Since that time he has been active as an independent oil operator and drilling contractor.

Reed Roller Bit Makes Thomas Field Engineer

Dillard R. Thomas has been named Reed Roller Bit Co.'s new field engineer for the West Texas division, according to W. B. Noble, vice president and chief engineer.

Thomas, who has been with Reed since 1949, has worked as salesman, draftsman, engineer, and field engineer in Louisiana before being assigned to his new position.

Worthington Announces New Warehousing Program

Completion of Worthington Corp.'s warehousing expansion program has been revealed by D. E. Tessendorf, manager of the company's mechanical power transmission sales department. The program is designed to keep mechanical power transmission stocks flowing smoothly from the factory at Oil City, Pa., to key distribution points in the nation.

The warehouse locations are divided into three areas. Under the East Coast-Mississippi area, warehouses are located at Atlanta, Ga., Chicago, Cleveland, Ohio, and Kearny, N. J. In the Mid-Continent area, warehouses are at Fort Worth and Houston, Tex., Tulsa, and New Orleans, La. The West Coast-Rocky Mountain area covers San Francisco, Los Angeles, Portland, Ore., and Denver warehouses. The warehouses at each location contain sufficient stocks of Worthington Q-D sheaves and Worthington-Goodyear V-belts, in various sizes and constructions normally required in each area.

Fischer & Porter Makes Three Sales Promotions

Philip E. Sellers, formerly sales manager of Fischer & Porter Co., Hatboro, Pa., has been promoted to sales vice president of that company; Herman Kockritz, formerly southeastern divisional manager, becomes field sales manager; and William Trethaway, formerly sales engineer, becomes district manager of the Atlanta office.

Sellers joined F&P as a field engineer in 1947. Previously, he worked for Sinclair Refining Co. and Wright Aeronautical Corp. Kockritz started as a field engineer in the Atlanta office in 1947. Prior to joining F&P, he worked for Westinghouse Electric Corp. Trethaway joined the company in 1951. He has been a field engineer working out of the Philadelphia office since 1954.

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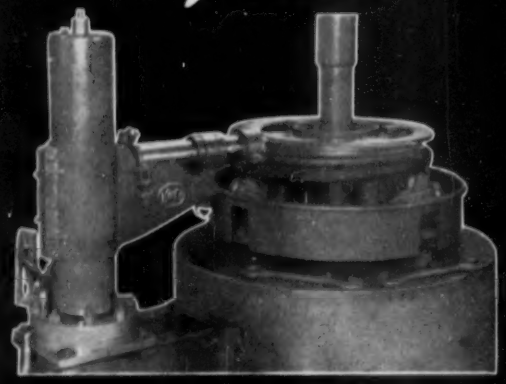

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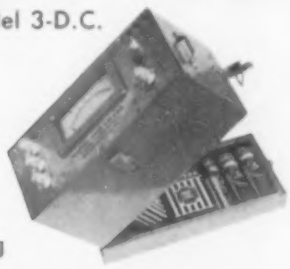

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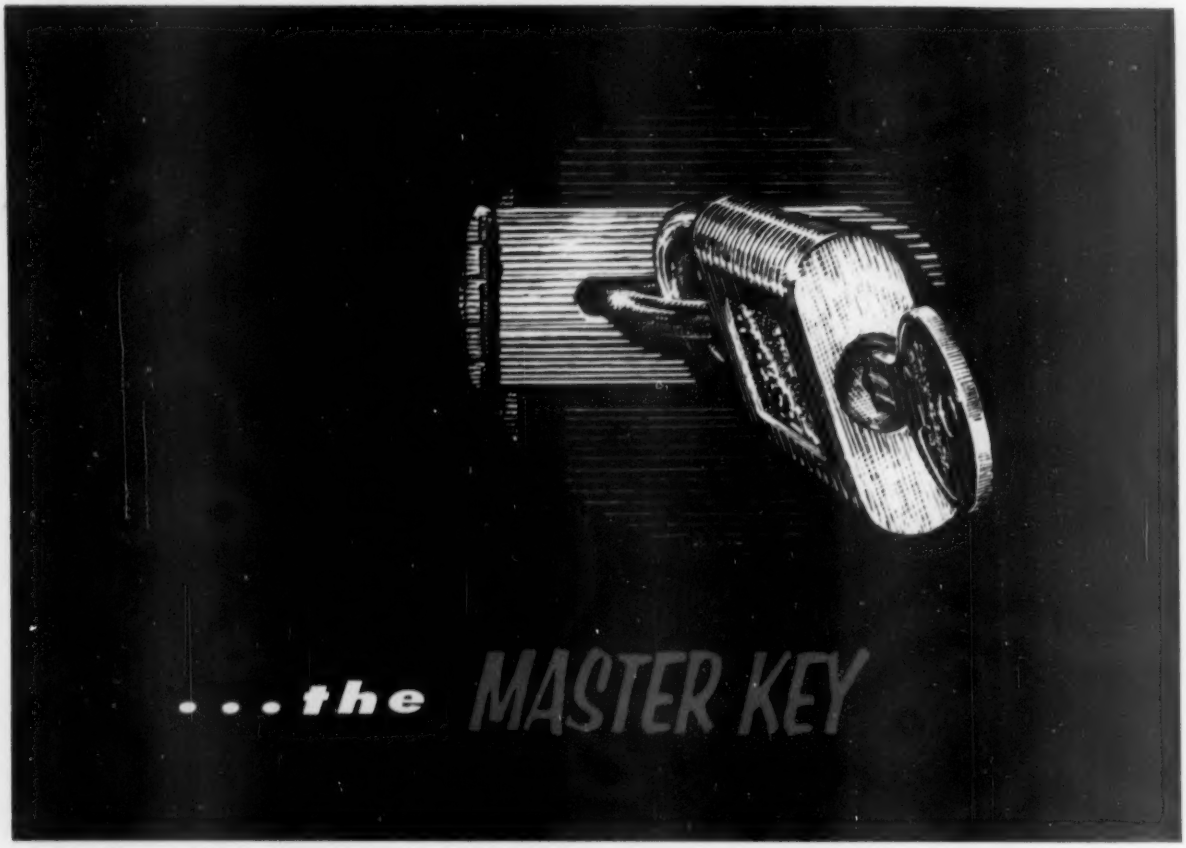

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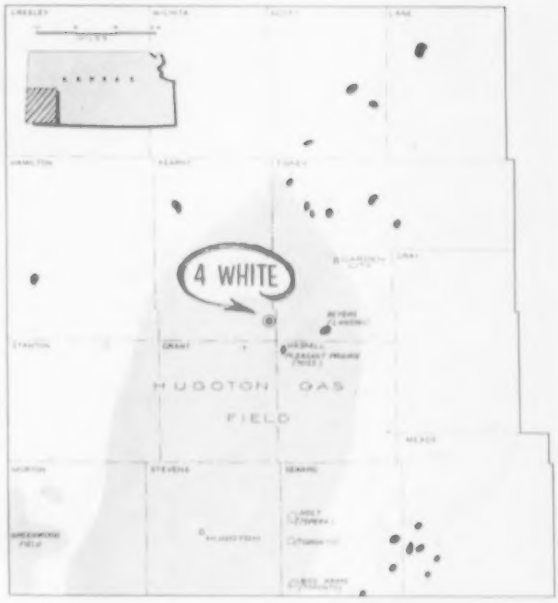
One Way to Find An Oil Field

by Frank J. Gardner



The Helmerich & Payne 4 White discovery in southeastern Kearny County, Kansas, emphasizes the neglected oil potential that underlies the vast Hugoton gas field of Kansas, Oklahoma, and Texas.

NO doubt you've heard the old yarn about the vice president's wife. It seems that in the X Oil Co., much wrangling takes place among geologists, engineers, and other scientists about where to spot the first wildcat on a prospect. The final decision is always made by the vice president's wife, who spots the well by throwing a dart at the map. Wherever it hits, they drill. And with amazing success.

Oil history is full of such legend. But you wouldn't think that such things happen today.

A happy ending . . . They do. And right here in Tulsa. It's not quite as bad as the dart story, but the crew at Helmerich & Payne, Inc., tell their tale unblushingly, for the ending is a happy one. They struck oil.

A couple of years ago, executives of Helmerich & Payne, a wholly owned subsidiary of White Eagle Oil Co., decided to start a search for new and deeper gas reserves on their 25,000-acre block in the vast Hugoton gas field; these were to be dedicated to Colorado Interstate Gas Co. in exchange for a renegotiated contract and a much-needed price increase. The big block, owned one-half by White Eagle, three-eighths by Wallace Gilroy, and one-eighth by Cleveland Arcade, was just about drilled up with Permian gas producers at the 2,700-ft. level.

Down came the order to the geological department: "Prepare a subsurface contour map of the area on the top of the Winfield-Chase, aimed at spotting possible deeper structures in the underlying section."

The brass waited. No map. It was a tedious job, and geologists are notoriously slow at tedious jobs. Impatiently, one official pointed to the area map and said, "Drill here. We'll look at the contour map later."

They drilled. Helmerich & Payne 1 Jones pierced the complete Permian and Pennsylvanian section and tapped a fine Mississippian oil pool at 5,100 ft. It pumped 167 bbl. a day of 37°-gravity crude with no water on May 12, 1954. It was Haskell County's first oil well.

Dispels a prejudice . . . The operators were a bit baffled. Here they'd committed themselves to find new deep gas reserves, but instead they had an oil field on their hands. "Pleasant Prairie" they named it. Other companies in this part of the state looked askance at Mississippian pools—they all had water troubles. There was no outlet for the oil, and little prospect of one, for nobody believed a Mississippian pool would pan out.

Six months went by. Then H. & P. decided to go ahead and see what they had. Today, they have eight oil wells, 1,400 proven acres, no dry holes, no water yet. Fluid levels and pressures have held up exceedingly well. Shamrock Oil & Gas Co. is trucking production from the field. The average initial potential of all the wells has exceeded 300 bbl. daily, and one well, 23 Jones, had a swab test of 100 bbl. per hour. The company places field reserves at about 175,000 bbl. per well, and the wells cost $80,000 apiece. This compares to a $30,000 price tag on the average Permian gas well in the field.

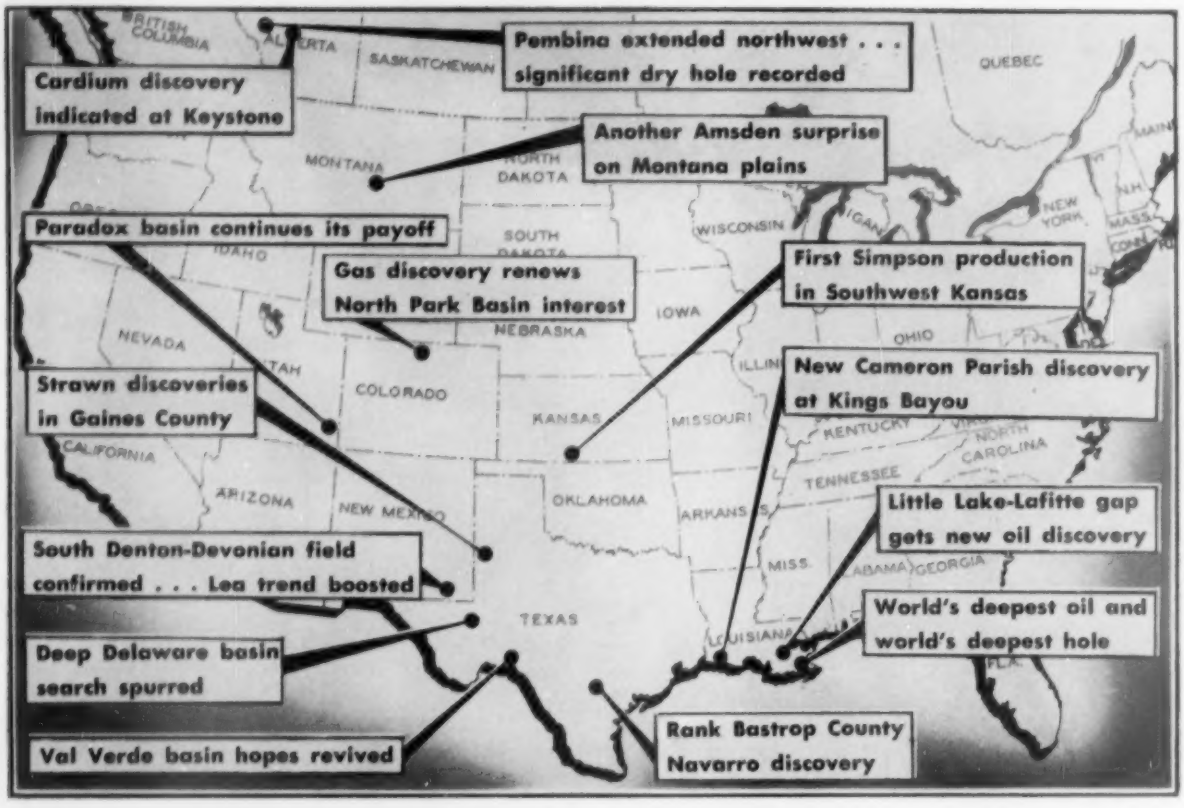
The structure at Pleasant Prairie is a north-south anticline with only 50 to 60 ft. of relief. It still isn't defined. Porosity averages 14.5 per cent, permeability 1,068 md., oil saturation 16.9 per cent, and water saturation 31.8 per cent. Two Mississippian zones have proved productive.

And leads to new horizons . . . But more important than these field facts are the many shows and flows that Pleasant Prairie wells have registered on the way down. In the Pennsylvanian, shows of oil have been found in the Lansing-Kansas City, the Cherokee, Marmaton, and the Morrow.

Today, the H. & P. offices are agog over the latest surprise in their Hugoton drilling. Five miles northwest of Pleasant Prairie field, their 4 White is opening Morrow oil production in southeastern Kearny County (see map). This wildcat has also indicated production from several zones in the top of the Mississippian—MicroLog study revealed three breaks that had been overlooked in the original sample studies; after fracturing, these zones pumped as much as 30 bbl. hourly. But the well, still in the final stages, has been plugged back for tentative Morrow completion at 4,975 ft. or so. Dual completion in the Mississippian has not been ruled out, and a planned 1-mile stepout to the west will help tell the story of the new strike.

The moral of this story is: Hugoton operators seem to have little conception of just what they're sitting on. Underlying the enormous expanse of Hugoton field must be numerous Pennsylvanian and Mississippian oil pools. They can be found by subsurface geology. The jinx on Mississippian reservoirs has been dispelled. And if a pipeline company can be lured into the field, Hugoton will bristle with deep drilling.

Helmerich & Payne has shown the way. Others should take note. Oh, yes—they finally finished the map. And wouldn't you know it? They'd drilled in a low.



Other April discoveries step aside as . . .

World's Deepest Hole Flows Deepest Oil

by John C. McCaslin

ALL but three of North America's petroleum provinces were heard from in April, but the month's discoveries were forced into the background as Richardson & Bass et al set a new producing depth for the world at the costly 1-L Humble-L.L.&E. wildcat in Plaquemines Parish, Coastal Louisiana.

Record added to record . . . The most significant exploratory story of this decade has been written in the marshes of southern Louisiana this year. Not only did Richardson & Bass et al dig the world's deepest hole in this region, but they established the world's deepest production in the same well.

The 1-L Humble-L.L.&E. flowed 206 bbl. of 38°-gravity oil per day on ⅛-in. choke from Miocene sands at the costly depth of 21,443-65 and 21,419-35 ft., adding 3,500 ft. to the old producing-depth record set 2 years ago at Coles Levee in Kern County, California. That well, Richfield Oil Corp. 67-29 K. C. L., produced from the Eocene at 17,500-17,892 ft. However, the well is no longer producing at that depth. Deepest production until April was from Shell Oil Co.'s Weeks Island field, about 100 miles from the Richardson & Bass well. The 1 C. B. Patout flows gas and condensate from the Miocene at 17,558-84 ft. The Richardson & Bass wildcat set the world's depth record several weeks ago when it drilled to 22,570 ft.

. . . Other Louisiana laurels. Shell Oil Co. opened a new gas-condensate field in coastal Cameron Parish, where more than a half dozen new deep fields have been opened in the past 12 months.

The 1 James M. Meaux in the Kings Bayou area, 5 miles northwest of Hog Bayou field, flowed 74 bbl. of condensate and 3,057 M.c.f. of gas per day from the Miocene sand. Drilling is under way at the first confirmation try, the 1 John Meaux, east offset to the discovery. The area, 2 miles inland, is about 5 miles northeast of Creole field, a mile from shore and Louisiana's first field in the open waters of the Gulf of Mexico.

Richardson & Bass opened a new deep oil area between Little Lake and Lafitte fields, 25 miles south of New Orleans in Jefferson Parish. The 1 State Lease 2372, 2 miles east of production at Little Lake, and ½ mile southwest of Lafitte, flowed 147 bbl. of oil per day.

Remote Texas exploration . . . Exploratory success in Texas was far-flung. New interest was stirred in the Val Verde basin, the deep unknown of the Delaware basin, the northern end of the Balcones fault trend fields in Southwest Texas, and in the Gaines County portion of the Midland basin.

Magnolia Petroleum Co. opened gas production in a remote wildcat area of little-explored Val Verde County in far

Total April Completions, Exploration and Development

	Total completions					Total wildcat wells					Cable tool comp.	Active operations
	Total	Oil	Gas	Dry	Footage	Total	Oil	Gas	Dry	Footage		
Alabama	6	4	0	2	56,807	2	0	0	2	11,102	0	17
Arkansas	62	32	2	28	219,394	13	2	0	11	50,746	4	66
California	193	124	4	65	910,936	53	4	0	49	281,936	12	206
Colorado	104	29	10	65	530,244	48	2	3	43	239,519	0	108
Georgia	2	0	0	2	8,264	2	0	0	2	8,264	0	1
Idaho	1	0	0	1	4,017	1	0	0	1	4,017	0	1
Illinois	292	143	5	144	682,627	61	7	0	54	121,655	22	457
Indiana	43	15	1	27	72,055	10	2	0	8	20,697	29	66
Kansas	431	204	33	194	1,449,808	93	15	1	77	350,197	87	405
Kentucky	120	49	10	61	168,291	21	0	0	21	23,432	99	215
West	103	48	0	55	113,025	21	0	0	21	23,432	84	165
East	17	1	10	6	55,266	0	0	0	0	0	15	50
Louisiana	278	161	16	101	2,011,032	60	18	2	40	531,319	0	392
North	120	70	11	39	441,504	24	4	1	19	114,197	0	116
South	128	70	3	55	1,292,786	32	12	0	20	375,787	0	204
Offshore	30	21	2	7	276,742	4	2	1	1	41,335	0	72
Michigan	25	11	1	13	63,049	9	0	0	9	21,620	21	91
Mississippi	42	20	0	22	342,509	15	0	0	15	124,573	0	27
Montana	13	7	0	6	90,214	5	1	0	4	32,776	1	48
Nebraska	99	28	0	71	558,543	52	4	0	48	277,514	0	67
West	94	28	0	66	540,803	47	4	0	43	259,774	0	58
East	5	0	0	5	17,740	5	0	0	5	17,740	0	9
Nevada	1	0	0	1	9,518	1	0	0	1	9,518	0	4
New Mexico	149	71	60	18	664,535	14	6	0	8	88,307	18	220
Northwest	64	2	57	5	251,180	2	1	0	1	8,910	1	77
Southeast	85	69	3	13	413,355	12	5	0	7	79,397	17	143
New York	27	11	1	15	47,132	0	0	0	0	0	27	11
North Dakota	20	14	0	6	182,538	6	3	0	3	41,088	0	27
Ohio	82	41	16	25	214,949	1	0	0	1	4,278	79	213
Oklahoma	703	440	31	232	2,451,842	69	6	3	60	315,948	53	1,037
Oregon	2	0	0	2	9,470	2	0	0	2	9,470	0	0
Pennsylvania	65	30	2	33	123,752	0	0	0	0	0	59	92
South Dakota	1	0	0	1	4,533	1	0	0	1	4,533	0	1
Texas	1,838	1,161	69	608	7,886,362	447	63	15	369	2,203,295	66	1,409
North (9)	395	223	4	168	1,147,200	92	15	1	76	294,213	27	133
West Central (7-B)	285	148	1	136	898,221	98	15	0	83	338,807	8	184
West (7-C & 8)	499	417	4	78	2,541,182	79	11	0	68	484,038	23	496
Panhandle (10)	79	60	10	9	305,801	8	1	2	5	63,154	0	115
East (5 & 6)	74	36	3	35	356,180	26	2	0	24	117,039	0	115
Southwest (1)	149	94	1	54	472,532	43	6	1	36	174,524	2	66
Gulf Coast (2)	66	25	11	30	404,977	23	2	1	20	150,260	0	51
Gulf Coast (3)	172	100	17	55	1,181,213	45	6	7	32	380,476	0	152
Southwest (4)	119	58	18	43	579,056	33	5	3	25	200,784	6	97
Utah	11	4	4	3	57,675	4	0	1	3	18,783	0	34
West Virginia	59	3	43	13	168,375	2	0	1	1	11,204	56	163
Wyoming	57	44	1	12	271,362	9	1	0	8	63,470	15	143
Total April 1956	4,726	‡2,646	309	‡1,771	19,260,413	1,001	*134	26	841	4,869,261	648	5,521
Total March 1956	4,360	2,502	287	1,571	17,926,244	910	131	26	753	4,381,524	728	5,422
Cumulative 1956	18,656	10,324	1,222	7,110	76,651,977	4,089	572	118	3,399	19,746,205	2,715	
Cumulative 1955	18,045	10,351	1,032	6,662	72,237,000	3,816	594	118	3,104	18,366,000		
Western Canada	77	49	2	26	404,705	28	4	1	23	148,659		
Alberta	47	31	2	14	288,061	15	2	1	12	97,301		
Saskatchewan	24	15	0	9	98,642	10	2	0	8	40,854		
Manitoba	5	3	0	2	13,780	2	0	0	2	6,282		
British Columbia	1	0	0	1	4,222	1	0	0	1	4,222		
Cumulative 1956	742	529	29	184	3,687,747	201	32	18	151	1,032,908		

‡Incl. 85 service wells: Ill. 1, Kans. 8, N. Y. 11, Ohio 2, Okla. 34, Pa. 28, Tex. (3) 1. ‡Incl. 45 dist. wells: N. La. 6, S. La. 17, La. offshore 1, Miss. 2, Okla. 16, W. Tex. 2, Tex. Panhandle 1. §Ind. 13 cond. disc.; N. La 1, S. La. 8, Okla. 3, Tex. Panhandle 1.

southwestern Texas. The 1 Morrison, an Ellenburger discovery at 13,944-14,062 ft., flowed 1,182 M.c.f. per day. The highly significant discovery is more than 30 miles west of the Vinegarone gas area, the county's only other productive area. Nearest production is about 20 miles northwest at Pandale field in Crockett County. Geologically, the well is in the Val Verde basin.

. . . Shell hits in Delaware basin. Shell Oil Co. made one of the most important discoveries of the year in West Texas at its 17-A University, Delaware basin wildcat in Winkler County. The significant wildcat flowed gas and condensate from the deep Pennsylvanian, one of the goals of all basin exploration. The importance of this deep test lies in its geological location along the eastern rim of the big basin, where the formations pinch out against the west flank of the Central Basin Platform. It is in these pinchouts that operators are hopeful of finding oil-bearing stratigraphic traps. The discovery well also had Wolfcamp-Permian production.

Bastrop strike . . . Sunray Mid-Continent Oil Co.'s closely watched deep test 15 miles northeast of Bastrop, Tex., was completed as a small oil discovery more than 20 miles from nearest production at the northeast extremity of the Balcones fault zone fields. Production is from the Lower Cretaceous-Sligo formation at the 1 Mollie Holme. The well is one of the deepest tests ever put down in Bastrop County, or any adjoining county in this southwestern Texas region.

. . . Gaines County. Northern Gaines County recorded two Pennsylvanian Strawn oil discoveries. Husky Oil Co. et al 2 Webb added Strawn pay to Seagraves-Devonian field. Husky opened another Strawn field between Russell and Seminole fields.

Total Depth Classifications, April 1956

	0-1,250 ft.	1,250-2,500 ft.	2,500-3,750 ft.	3,750-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	10,000-12,500 ft.	12,500-15,000 ft.	Over 15,000 ft.
Alabama	0	1	0	0	0	1	4	0	0
Arkansas	0	24	16	11	8	3	0	0	0
California	19	40	33	35	27	24	10	5	0
Colorado	5	1	3	24	71	0	0	0	0
Georgia	0	1	0	0	1	0	0	0	0
Idaho	0	0	0	1	0	0	0	0	0
Illinois	23	126	142	1	0	0	0	0	0
Indiana	9	25	9	0	0	0	0	0	0
Kansas	5	64	198	150	14	0	0	0	0
Kentucky	75	28	11	6	0	0	0	0	0
West	74	26	3	0	0	0	0	0	0
East	1	2	8	6	0	0	0	0	0
Louisiana	3	53	30	16	44	48	46	31	7
North	3	52	27	7	23	4	4	0	0
South	0	0	3	8	17	33	34	26	7
Offshore	0	1	0	1	4	11	8	5	0
Michigan	2	16	3	3	1	0	0	0	0
Mississippi	0	0	0	8	16	6	9	3	0
Montana	0	1	1	1	3	7	0	0	0
Nebraska	0	1	3	22	72	1	0	0	0
West	0	1	1	19	72	1	0	0	0
East	0	0	2	3	0	0	0	0	0
Nevada	0	0	0	0	0	1	0	0	0
New Mexico	5	24	48	27	31	4	6	4	0
Northwest	1	19	17	3	23	1	0	0	0
Southeast	4	5	31	24	8	3	6	4	0
New York	0	24	0	3	0	0	0	0	0
North Dakota	0	0	2	1	3	14	0	0	0
Ohio	17	9	52	3	1	0	0	0	0
Oklahoma	79	191	212	100	75	35	8	3	0
Oregon	0	1	0	0	1	0	0	0	0
Pennsylvania	0	60	0	0	4	1	0	0	0
South Dakota	0	0	0	1	0	0	0	0	0
Texas	133	426	343	360	315	187	51	20	3
North (9)	49	183	39	67	45	11	1	0	0
West Central (7-B)	22	109	61	49	42	2	0	0	0
West (7-C & 8)	12	64	107	134	88	51	24	18	1
Panhandle (10)	0	4	63	1	3	6	2	0	0
East (5 & 6)	6	6	9	16	32	4	1	0	0
Southwest (1)	28	29	30	45	13	1	2	0	1
Gulf Coast (2)	0	2	1	17	19	26	1	0	0
Gulf Coast (3)	9	12	11	14	43	64	16	2	1
Southwest (4)	7	17	22	17	30	22	4	0	0
Utah	0	0	2	1	8	0	0	0	0
West Virginia	4	24	13	15	3	0	0	0	0
Wyoming	4	10	8	7	23	4	0	0	1
Total April 1956	383	1,150	1,129	796	721	336	134	66	11
Total March 1956	405	969	1,063	753	626	349	129	56	10
Cumulative 1956	1,719	4,307	4,449	3,012	2,829	1,458	578	268	36
Western Canada	1	6	12	17	28	11	2	0	0
Alberta	0	4	2	2	26	11	2	0	0
Saskatchewan	1	0	8	13	2	0	0	0	0
Manitoba	0	2	2	1	0	0	0	0	0
British Columbia	0	0	0	1	0	0	0	0	0
Cumulative 1956	4	66	83	200	325	58	5	1	0

Lea Trend boosted . . . The "Devonian Trend" in northeastern Lea County, southeastern New Mexico, reported a significant addition at Ralph Lowe 1 Wallace, 3 miles northeast of Gladiola-Devonian field. The discovery flowed at the rate of 2,640 bbl. of oil per day from Devonian pay at 11,990-12,046 ft.

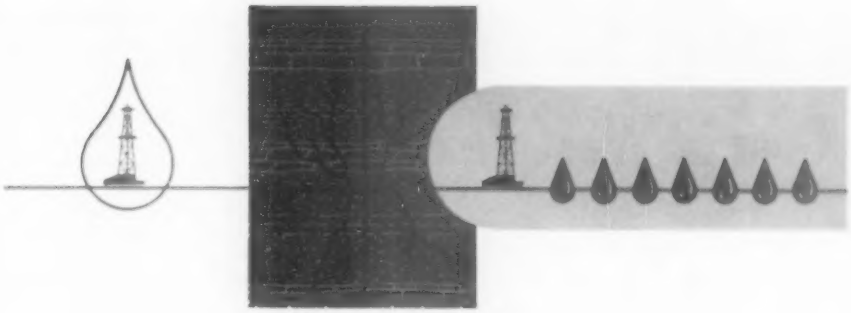
The Devonian is the object of intense exploratory drilling along the eastern border of southeastern New Mexico. A total of 28 Devonian fields are producing about one-fourth of the state's current output. Geologists in the region think that Devonian structures apparently are on parallel ridges, with a north-south alignment. One such ridge has been indicated as running north-south through Bagley field and another the same direction through Denton field. The new strike north of Gladiola tends to support this theory.

Spring in the Rockies . . . Colorado, Utah, and Montana shared the exploratory spotlight in the Rocky Mountain province.

. . . North Park basin. Cabeen Exploration Co. 1 Blevins, Jackson County, flowed gas at the rate of 2,500 M.c.f. per day from the Frontier, reviving somnolent exploratory interest in Colorado's North Park basin. Location is 4½ miles east of North McCallum field, a Morrison Dakota-Lakota producer.

. . . Amsden success. R. P. Oliver 3 State flowed oil at the estimated rate of 60 bbl. hourly on test of the Amsden-Heath transition zone to add further interest to the quickening exploratory campaign on the Central Montana Plains. This Musselshell County discovery is 9 miles west of Northwest Sumatra field where the Amsden play began last year.

. . . Paradox paying off. The rewarding oil search in the Paradox basin of southeastern Utah is becoming one of the exploratory tales of 1956. The new Anneth area in San Juan County was confirmed in April, and production is now assured at other wells in the Pennsylvanian reservoir. The discovery well, The Texas Co. 1 Navajo, flowed 1,704 bbl. of oil per day on completion in February. The gratifying success at Anneth boosted the basin's exploratory stock to its highest level since the wildcat drills moved into the area.



squirrel sand stripper BECOMES PRODUCER

AFTER HALLIBURTON'S

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A Squirrel Sand well in Coffey County, Kansas, had only a show of oil on test. After Halliburton VERTIFRAC treatment it made 25 BOPD, and six weeks later was still making 20-25 barrels. Sustained production following *conventional* treatment in that area is normally reported around 5 BOPD.

FRACTURES VERTICALLY IMPERMEABLE BARRIERS

Many other Vertifrac-treated wells show comparable or greater production increases. Some occurred after conventional fracturing failed. Why? Theory says that Vertifrac produces vertical fractures through formation layers which are normally impermeable except horizontally. Ordinary fracturing tends to follow the most permeable planes which may be between shale streaks or along bedding planes. That's why potential horizons are often left untouched because of barriers to vertical flow from adjacent producing intervals.

"THICK WALL" PRINCIPLE UTILIZED

Halliburton's Vertifrac Service utilizes the "thick wall" principle of geodynamics. First, a circulation-loss material is applied in fluid under pressure to open hole. This seals incipient fractures and permeability. Next pressure is sharply increased, until formation breakdown occurs. Since normal outlets are blocked, many of the resulting fractures are vertical. Finally, conventional fracturing fluids under pressure complete the job, creating profitable oil flow channels.

Consult with Halliburton's long-experienced field personnel on whether your production problem can be solved with Vertifrac. Call your local or district office of the Halliburton Oil Well Cementing Company.

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Drilling Survey Shows Spraberry Is Holding Its Own in West Texas

by Carl Hoot

A 4-WEEK Journal survey of drilling in West Texas and Southeast New Mexico shows that roughly a third of all wells are completed as pumpers; that the Spraberry is still holding its own as a drilling objective; and that Gulf Oil Corp. drilled the highest number of wells of any major company over that particular period.

Out of 506 wells completed during this period, Gulf drilled 39—or 9 per cent. Of these, 38 were oil wells and 1 was dry. Magnolia Petroleum Co. was second with a total of 18, and Stanolind Oil & Gas Co. was next with 13 wells.

These figures are based on completions reported during the 4 weeks and do not tie in with the Journal's weekly or monthly completion data. They were compiled as part of an experimental punch-card project now being conducted by the Journal's exploration department.

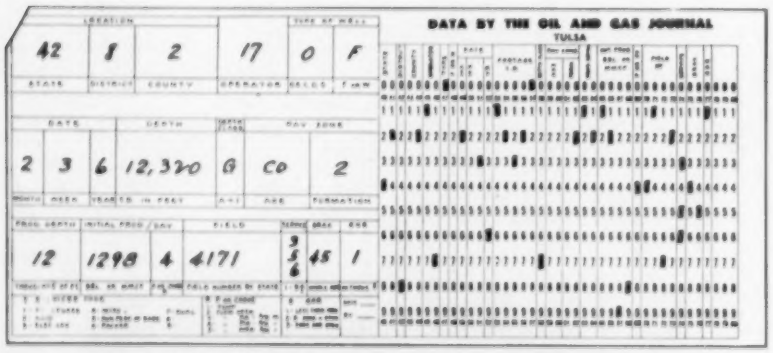
Shallow pays most active . . . Permian zones still come in for the biggest share of drilling in both West Texas and New Mexico fields. In West Texas, the San Andres accounted for 39 per cent of all producers in this 4-week survey, with a total of 145 oil wells finished in that pay. Grayburg was next with 33 total, or 9 per cent, and the Queen sand was third highest with 28 wells and 7 per cent of the total.

In Southeast New Mexico, the highest number of completions were in the Queen sand, Wolfcamp, and miscellaneous Permian—in that order. While there is a good drilling and exploration program under way in Lea County (shooting for the Pennsylvanian and Devonian rocks), there were no deep completions reported during the 4 weeks surveyed.

Clear Fork completions in West Texas, spurred by a redevelopment program in Spraberry Trend fields, accounted for 22 oil producers and 1 gas well during the time of this survey. Spraberry drilling surpassed the Clear Fork, with a total of 28 oil wells plus 1 lower Spraberry well classified as a Dean sand well.

THE PERMIAN BASIN'S "BIG FIFTEEN" IN DRILLING

Company—	Oil	Gas	Dry	Total
Gulf	38	0	1	39
Magnolia	18	0	0	18
Stanolind	13	0	0	13
Shell	9	0	2	11
Continental	9	0	1	10
Humble	9	0	1	10
Standard of Texas	7	1	1	9
Cities Service	7	0	0	7
Phillips Petroleum	6	0	1	7
The Texas Co.	6	0	1	7
Superior	5	0	1	6
Plymouth	6	0	0	6
Tide Water	5	0	0	5
Sunray	4	0	1	5
Atlantic	5	0	0	5
Other operators	261	4	83	348
Total	408	5	93	506



THIS SAMPLE DATA CARD is a West Texas development oil-well completion record. Decoded, it reads: Texas (42); Texas Railroad Commission District 8 (8); Andrews County (2); Cities Service Oil Co. (17); oil well (0); field well (F); Completed February (third week) 1956; T.D. 12,320 ft. Depth class is 10,500-12,500 ft. Cambrian-Ordovician (CO); Ellenburger (2); produces in the 12,000-ft. zone; flowed 1,298 bbl. of oil a day through 3/4-in. choke (4). Deep Rock-Ellenburger field (4171). The well was electrically logged (3), gun perforated in open hole (5), packer was used in completion (6).

Field developing . . . West Texas fields with the largest number of wells completed were headed by the Spraberry Trend areas, which had 16 oil wells. These did not include workovers being plugged back from the Spraberry to the Clear Fork.

McFarland, a Permian producing area in Andrews County, was second highest with 13 oil wells. McElroy, in Crane and Upton counties, had 12 producers finished. Howard-Glasscock had 12, and Ward-Estes reported 12.

Well services . . . Of interest to service companies is the fact that 80 per cent of all wells in Southeast New Mexico were surveyed by various electrical-logging methods. This item on West Texas well reports was not complete, but estimates from logging companies indicate that over 90 per cent of all wells are electrically logged.

Fracturing, as a standard method of completion in tight sandstones, is gaining steadily. Out of 34 producers in one New Mexico area, 31 had been fractured, 32 were gun-perforated, and 31 had some form of acid treatment.

While fracturing was given a boost by tight Spraberry wells, it is almost standard procedure in the San Andres zone also.

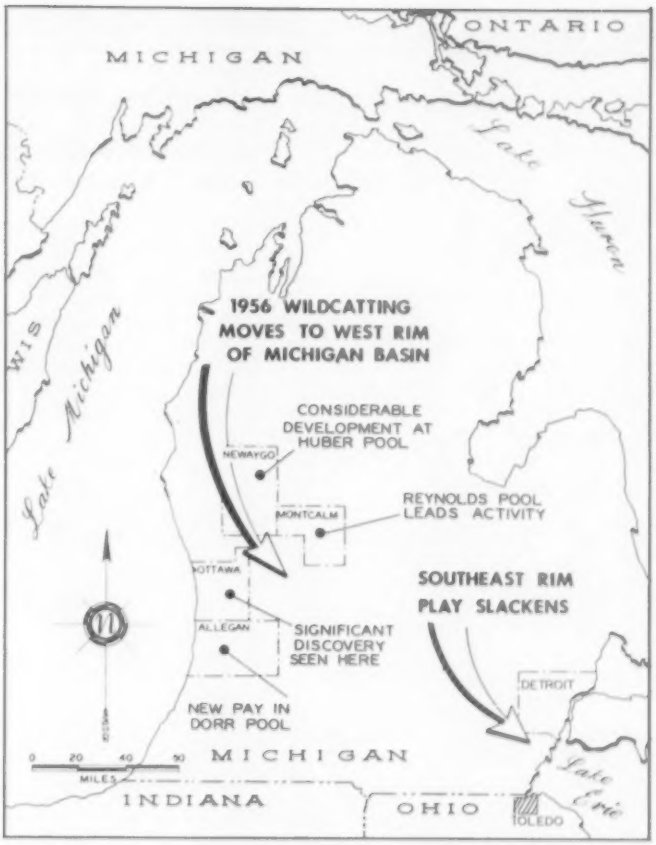
In West Texas fields, the survey showed 196 wells fractured, 155 had acid treatment, 3 were completed with the aid of nitro shots, and 377 were gun-perforated. These figures were out of a total of 374 oil-well completions.

Pumping wells . . . The survey showed that Southeast New Mexico operators put about a third of all their wells on the pump at time of original completion. Total West Texas wells on the pump at completion time ran near 40 per cent.

The following table shows West Texas counties having the highest number of pumping completions:

County—	Wells
Howard	27
Mitchell	18
Andrews	19
Ector	17
Crane	12
Crockett	12
Scurry	5
Others	78
Total	188

Total drilling . . . In this 4-week survey period, Southeast New Mexico operators completed 88 wells. By county, totals were: Lea, 69; Eddy, 11; and Chaves, 8.



Wolverine exploration interest shifts as

Michigan Looks West

by Don Carr

WHILE in the past 2 years the highlighted area for exploration in Michigan was in the southeastern portions of the Michigan basin, with Niagara-Silurian, Salina-Silurian, and Trenton-Ordovician as objectives, new wildcatting development in 1956 appears to be concentrated on the west and west-central rim of the basin. Considerable leasing and other wildcatting arrangements have been in progress in Newaygo, Oceana, Mason, Montcalm, and Mecosta counties.

The spring drilling campaign came late in Michigan this year. All of the troubles encountered by the industry in getting away to an active operation were not the fault of the weather. Lack of discoveries and successful developments in areas discovered earlier have slowed operations generally.

During the first 4 months of the current year, final well completions dropped to 152. Of these 69 were oil wells, 4 were gas wells, and 79 were failures. In the same period last year, completions totaled 164. These were 62 oilers, 3 gassers, and 99 dry holes. New drilling permits (discounting 28 gas-storage-field service-well permits) totaled 147 to May 4, 1956, compared to 168 to May 6, 1955.

Total monthly oil runs from all Michigan pools have dropped to below 1,000,000 bbl., but this state, with a refining capacity in excess of 150,000 bbl. of oil per day, which is bolstered by oil imported from the Southwest and Canada, is bound to be the scene of a fairly active wildcatting program for many years, despite the extended cycle of unsuccessful exploration.

The score to date . . . Only two new pool discoveries and one major pool extension have been scored this year. The extension, an outpost 1 mile east of Reynolds pool in Montcalm County, appears to be the most significant of these successes. Tests of Dundee-Monroe (Devonian) oil pays in a Robinson Township, Ottawa County, wildcat at 2,110 ft., may prove to be of major significance to southwestern Michigan development before the end of the year. This new deeper-pay well, coupled with successful completions in the Detroit River (lower Devonian), and a possible new pay in the middle Salina zone in Dorr pool, Allegan County, offers promising prospects for accelerated drilling, both wildcatting and development, in the shallow district.

. . . Reynolds leads. The most stimulating area, both to new wildcat development and field drilling, is Reynolds pool in Montcalm County, opened in 1954.

Earlier this year William Cline completed an extension, which coupled with further development expansion of the pool both to the south and east, has made Reynolds the most important new field development in Michigan in the past 10 years. To date, 14 Reed City-Dundee oil wells, and 1 Traverse oil producer have been completed in the field on a 40-acre well-spacing pattern. The area, yet undeveloped, appears to encompass from 1,000 to 1,500 acres. Bulk of the field will be owned by the discovery group, McClure, Swan-King, Basin Oil Co., and G. Ackermann. Current development program in the field should keep from five to seven rigs active for the rest of this year. Ultimate oil recovery from this pool, estimated on basis of proved reserves, is expected to exceed 5,000,000 bbl.

. . . Huber. The west rim of the Michigan basin was limelighted late in 1955 with the discovery of Huber-Traverse oil pool in Denver Township, Newaygo County, where considerably more development is in prospect for the first 9 months of 1956.

Regional picture . . . The Michigan basin, a structural depression, includes the Southern Peninsula and the east part of the Northern Peninsula of Michigan, parts of eastern Wisconsin, northeast Illinois, northern Indiana, northwestern Ohio, and southwestern Ontario.

This basin was one of the nation's first areas to be found productive of oil and gas. The shallow east, south, and west rims of the basin were first explored for oil. It has been only in the past 25 years that deeper production inside the basin was established.

The oil and gas reservoirs in the basin occur on anticlinal folds, a result of uplift during late Paleozoic time. Oil and gas occur in the porous limestone and dolomites of Middle Ordovician, middle and late Silurian, and middle Devonian age.

EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. is moving in at 4092 J. G. Mailey, rank wildcat. It is on the Donegal Quadrangle 3.66 miles south of latitude 40 degrees 15 minutes and 3.70 miles west of longitude 79 degrees 20 minutes, elevation 1,879 ft.

● Young Township, Indiana County, Manufacturers Light & Heat Co. 4336 Stewart & R. & P Coal Co., rotary outfit started and is at 4,500 ft.

OHIO

A west offset to the new pool at Gratiot produced 90 bbl. with 500,000 cu. ft. gas in a 24-hour test after fracturing. Completed by Scott Oil Co. on 1 L. G. Fink, Section 20, Hopewell Township, Licking County, the Clinton was reported at 3,160-3,200 ft. with a fair showing natural.

● A wildcat on J. E. Archer, Section 21, Noble Township, Noble County, was drilled into the Medina shale to a total depth of 5,686 ft. Clinton was logged at 5,519-5,615 ft. with an oil showing at 5,518-83 ft. and gaged 3 bbl. A. F. Baron Kidd and Frank Irvin, the operators, decided to plug and abandon.

EASTERN KENTUCKY

In Breathitt County and located in the recently discovered Turner pool, Preston Oil Co. is waiting on orders at 1519 Ervine Turner. The salt sand carried only a light show of oil from 1,426 to 1,428 ft. Total depth of hole is 1,432 ft. in shale.

WEST VIRGINIA

● St. George district, Tucker County, West Virginia, Columbian Carbon Co. 1-1219 U.S.A., wildcat, elevation 2,073 ft., was dry. Chert 4,224-4,319 ft., Oriskany sand 4,374 ft. Total depth 4,509 ft.

● Sherman district, Hampshire County, M. E. Anderson 1 J. E. & B. Orndorff has encountered a bad hole at 8,028 ft.

HUGOTON EMBAYMENT

NORTHWEST OKLAHOMA

New Location Announced In Active Harper Area

The fast-moving pre-Permian play in Harper County received two new wildcat locations last week. Woods Petroleum Co. will drill at the 1 Seevers in C NW NW 6-27n-20w, going to 8,000 ft. Monsanto Chemical Co. and An-Son Petroleum Corp. will drill the 1 Cosby, southwest of the city of Buffalo in C SW SE 17-27n-23w. This test will go to 6,800 ft.

Exploration This Week

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THE OIL AND GAS JOURNAL

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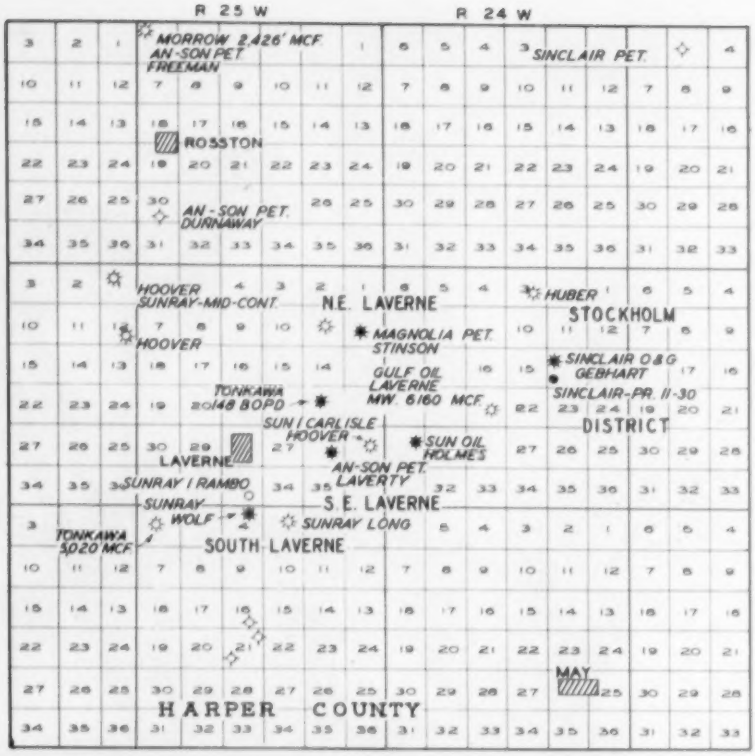

CURRENT drilling wells and recent completions are shown on map of Laverne and Stockholm districts, Harper County, Northwest Oklahoma. Base map courtesy Herndon Map Service, Oklahoma City.

Laverne area . . . Magnolia Petroleum Co. 1 Barby, C NW SE 6-26n-25w, in the new area west of Northeast Laverne field, is coring in the Hoover sand.

Sunray Mid-Continent Oil Co. completed the 1 Barby "A" in C SE NW 1-26n-26w, for 550 M.c.f. of gas per day on 26/64-in. choke from the Hoover sand at 4,195-4,282 ft.

Gulf Oil Corp.'s 1 Laverne State in SE NW 13-26n-25w, Laverne area wildcat, flowed 2,100 M.c.f. of gas per day on calculated open flow test of the Hoover sand at 4,270-4,326 ft. The well also has gas-distillate production in the Morrow sand.

Tonkawa Tested At Laverne Area Well

Cities Service Oil Co. is testing the Tonkawa-Pennsylvanian at its 1 McClung-A, NW NW SE 11-26n-25w, Northeast Laverne area, Harper County.

The zone 5,455-70 ft. flowed 3,200 M.c.f. per day on initial tests. After acid treatment the well flowed 13,700 M.c.f. per day with a distillate show. Through the Chester-Mississippian at 6,945-66 ft. the well flowed 9,500 M.c.f. per day on 12-hour test with some distillate.

Laverne . . . Gulf Oil Cop. tested the Hoover sand at the 1 McClung in SE SE NW 23-26n-25w. The perforations in this Pennsylvanian zone at 4,160-4,210 ft. flowed 3,880 M.c.f. per day on 4-hour test. Morrow perforations at 6,922-7,000 ft. flowed oil in commercial amounts.

MID-CONTINENT

OKLAHOMA

Gas-Distillate Flows At Grant County Strike

A Mississippi chat discovery in C NW SE 33-28n-7w, Grant County, northern Oklahoma, flowed gas-distillate from perforations at 4,972-5,020 ft. The discovery well is Barrett Petroleum Co. and Kay County Gas Co. 1 Lewis.

The well flowed 4,750 M.c.f. of gas per day and 15 bbl. of distillate per million. Flow was through a ¾-in. choke.

Third Oil Well Added To New Garvin Field

Superior Oil Co. added another Bromide oil well to a new pool in Garvin County at 1 McCorskey Unit, C SW

SE 7-4n-2w. The well flowed oil in 20 minutes at 40 bbl. per hour on a drill-stem test at 7,249-81 ft. Another test made at 7,281-7,311 ft. flowed oil in 22 minutes at 42½ bbl. hourly. The new Bromide sand pool is southeast of Southeast Story pool.

More Bromide Sand Exposed at McClain Hit

More Bromide pay sand was reported at Gulf Oil Corp. 1 Dyer, SE SW NE 20-6n-3w, McClain County discovery in south-central Oklahoma.

The well flowed 40 bbl. per hour on original flow at 10,170-80 ft. Later the well flowed 117 bbl. of oil in 4 hours on 14/64-in. choke from perforations at 10,120-10,200 ft. The last test reported flowed 146 bbl. of oil in 2 hours and 2,890 M.c.f. of gas on ½-in. choke. This well should make more than 1,600 bbl. of oil per day.

KANSAS

Lansing Discovery Seen For Sheridan County

Another discovery was reported on the southwestern flanks of the northern part of the Central Kansas uplift in Sheridan County.

Heathman-Seeligson Drilling Co. 1 Brown "A," NW NW NW 26-8s-27w, 4 miles west of Southwest Studley pool and 7 miles east of Hoxie, Kans., recovered 1,920 ft. of gas and 1,500 ft. of oil on Lansing drill-stem test at 3,860-3,910 ft. Another test at 3,911-30 ft. got 1,000 ft. gas and 570 ft. oil. Test of the Marmaton lime at 4,160-72 ft. recovered 35 ft. heavily oil-cut mud and 20 gal. free oil. A test in the Kansas City lime at 3,794-3,816 ft. recovered 300 ft. very heavily oil-cut mud. At 3,838-59 ft. the wildcat made 125 ft. heavily oil and gas-cut mud and 180 ft. gas.

This Sherman County success prospect is another in the growing chain of new pools being established in northwestern Kansas. In Thomas County, Bachus Oil et al are still testing at the 1 Kendig, NE NE SE 30-8s-32w, 5½ miles north of Mingo pool. This is also a Pennsylvanian discovery.

Big Gas Well Reported Shut In In Barber

Barber County has a new Viola gas discovery at Musgrove Petroleum Co.'s 1 McGrath, SW SW NW 16-33s-14w, 3 miles west of Medicine Lodge pool in the western part of the county.

The well flowed 51,000 M.c.f. of gas per day on open flow gage from the Viola at 4,639-67 ft.

ARK-LA-TEX

EAST TEXAS

Gas Show in Gum Springs Area

Shows of gas were reported while drill-stem testing a sand believed to be Woodbine, located on the eastern edge of Gum Springs pool in southwestern Rusk County. The well is La Gorce Oil Co. and Bill Tipton 1 Eva Jordan, Jessee Crawford Survey.

The above test was run at 3,510-3,640 ft., which had gas in 13 minutes and recovered 120 ft. of gas-cut mud. Operators prepared to set pipe after the test.

Carthage Oil Expanded

Oil production on the southwest flank of the big Carthage field in Panola County has been extended over 1 mile from the nearest wells. W. H. Bryant et al., Tyler, 1 A. H. Latham estate was ready for completion after testing in the Pettet at 6,138-42 ft. Following acid treatment through perforations, the well produced 106 bbl. of oil in 11 hours through ¼-in. choke. It was then shut in to erect storage tanks.

First shows of oil came on a drill-

2 of 13 SIZES

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stem test at 6,128-40 ft., which recovered 130 ft. of free oil, plus 5 ft. of salt water. Flowing pressure ranged to 230 psi.

Location of the well is 4 miles northwest of the town of Gary, in the G. Walton Survey, A-792.

NORTH LOUISIANA

Colquitt Area Extension Completed

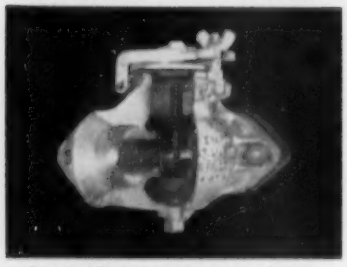
Stanolind Oil & Gas Co. has announced completion of an extension well in the Colquitt area of Claiborne Parish, Louisiana.

Stanolind 1 Gladne Unit, located in Section 25-23n-6w, Claiborne Parish, flowed 172 bbl. of 49°-gravity oil in 21 hours through a 13/64-in. choke. Completion of the well extends production in the Gladne Unit ½ mile east.

Production was from the Smackover "B" zone through perforations at 10,418-28 ft. Top of the "B" zone is 10,376 ft., total depth of the well 10,644 ft. and plugged back total depth of 10,480 ft.

Stanolind owns about 1,500 acres in the Colquitt area, of which 1,120 acres have been proved productive.

Enardo 1900 Series In-Line Vent Valve



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Enardo 800 series Vent Valves are offerred in standard 2", 3" and 4" pipe sizes, pressure settings ½ to 16 ounces. Featuring aluminum or semi-steel bodies with plastic trim. Slip-On or flanged ends. Standard valve is 1 ounce pressure, 4/10 ounce vacuum.

Enardo 1900 series Vent Valves also offered in 2", 3" and 4" sizes, with or without companion flanges bolted on. Standard valve 2 ounce pressure, 4/10 ounce vacuum. Pressure settings from 2 to 24 ounces.

Contact the representative nearest you for further information.

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ROCKY MOUNTAIN

WESTERN NEBRASKA

Operator Will Perforate Garden County Discovery

Roy G. Woods will perforate his Garden County discovery, the 1 McCord, C SW SW 19-17n-43w.

This well is the second discovery in the county. It is located 2½ miles northwest of the county-opener, Brinkerhoff Drilling Co. 1 Richards, C NE NE 28-17n-43w, finaled last winter. A drill-stem test in the "J" sand at 3,156-67 ft. recovered 1,700 ft. of oil at the Woods well.

NORTHWEST NEW MEXICO

Recompletion Reported at Bisti Field in San Juan

Bisti field's discovery well, El Paso Natural Gas Co. 1 Kelly State, SW NE NE 16-25n-12w, was completed last week for 646 bbl. a day, a recompletion. The well was first completed last year as a Gallup sand discovery, making 180 bbl. per day on ¼-in. choke.

Bisti field now has four wells completed. The wells produce from the Gallup, an Upper Cretaceous sand.

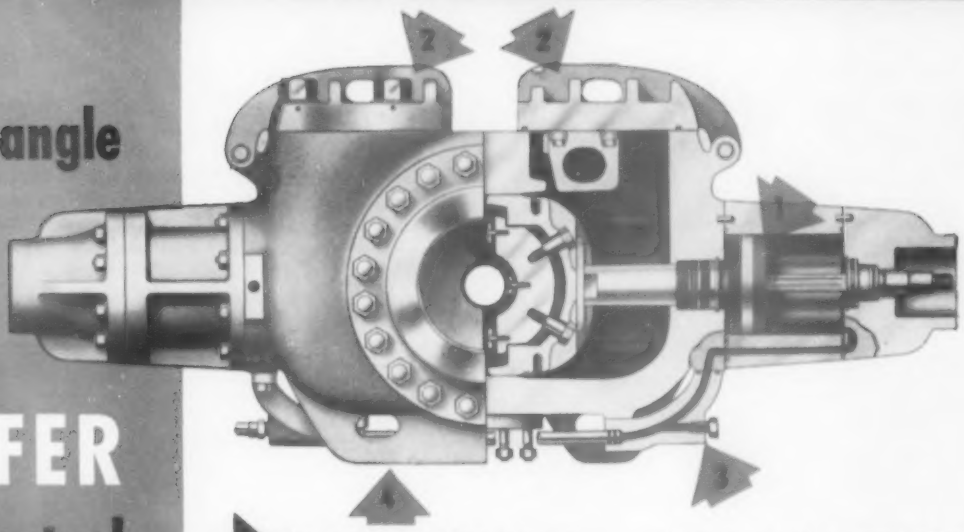
COLORADO

Hugoton Area Discovery Waiting on Pump

First oil production for Baca County in southeastern Colorado is now assured. The discovery well in this area is Provincial Oil Co. 1 State, C NW SE

Shell Oil Co. has made location for a rank wildcat in the Basin and Range province, 30 miles east of Ely, Nevada. Location is in 19-20s-19w, Millard County, Utah. The 1 Baker Creek Unit is in the C SW SE of the section. Nearest production is in Nevada's sole producing area, Eagle Springs, Nye County. Since this discovery there has been considerable leasing activity in the Basin and Range province, both in Utah, and in Nevada. The Shell test is the first in this region.

Another angle on SHAFFER Cellar Control Gate Features



TOP VIEW *emphasizes* BASIC DESIGN ADVANTAGES

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1 Note the *Single* hydraulic piston by which each ram is actuated. Not only is this piston *directly behind* the ram for maximum operating efficiency, but one-piston-per-ram means:

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b. Fewer hydraulic seals to maintain.
c. Simpler manifolding of hydraulic lines.
d. Easier servicing when necessary.
e. More-favorable ratio of piston area to piston circumferential seal — therefore less internal friction plus increased efficiency.

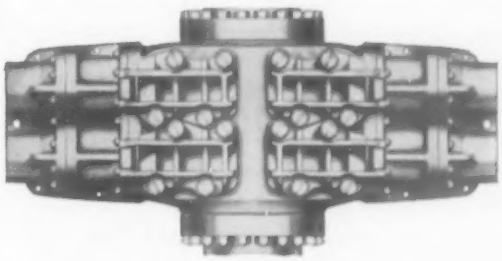
2 Note how the patented doors through which the rams are serviced open along the *side* of the gate where there is plenty of room.

There is no need to expand critical end dimensions of the gate for servicing the rams — nor is it necessary to allow extra space above the gate. Since end and height dimensions are the most critical ones in governing cellar requirements, Shaffer's basic advantages here are of paramount importance!

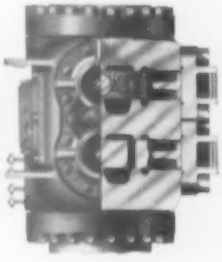
3 Note how all manifold connections are compactly unitized on one side of the gate. Connections are quick and easy to make — equally easy to service.

4 Note the sturdy integral ribs upon which the gate "slides" for easy loading, unloading and storage. This feature also protects against damage to studs, lines and other parts.

FRONT VIEW



END VIEW



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36-32s-43w, 8 miles southwest of Kansas' Greenwood gas field. The discovery swabbed oil at the rate of 72 bbl. daily from the Marmaton lime-Pennsylvanian at 4,152-4,203 ft. The well is now shut in, waiting for pump.

WYOMING

Field Conference

The Wyoming Geological Association will hold its Eleventh Annual Field Conference on Wednesday, Thursday and Friday, September 5, 6, 7, 1956. Registration will start at 1:00 P.M., Tuesday, September 4.

Headquarters for the conference will be at the Jackson Lake Lodge in Moran, Wyo., and daily field trips will be conducted throughout the Jackson Hole area in northwestern Wyoming.

The first day's trip will include a ride up the ski lift on Snow King Mountain in the morning to view the general tectonics of the Jackson Hole area. The afternoon will be spent inspecting Early and Late Tertiary Thrusting on the southwest flank of the Gros Ventre Mountains.

The second day of the conference will be spent on a trip along the Gros Ventre River up to Sohare Creek to study structural and stratigraphic conditions.

The final day will consist of a half-day trip from Moran through Togwotee Pass with additional road logs provided for unscheduled continuance to Dubois or Lander.

Information concerning reservations should be directed to K. W. Frielinghausen at Box 1571, Casper, Wyo.

GREAT LAKES

MICHIGAN

Ace Oil Co. logged an oil-water pay in the Traverse at a Sheridan Township wildcat, Newaygo County, which has been under pump-test natural. Well will be deepened in the Traverse before further testing is done. This wildcat, one of a series of tests in the general area, many of which have logged oil-water porosity zones that looked like near-commercial wells, was checked in structurally higher by some 19 ft. over older test wells. Regardless of ultimate outcome of this present wildcat, additional exploration is expected in this area.

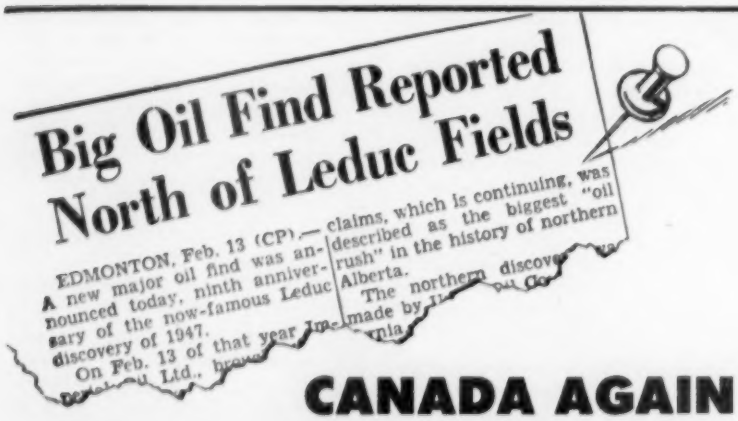
New oil-water showing wildcat is the Ace Oil Co. 1 Stone Est. 1, SW SW SW 22-12n-14w. Top of Traverse lime was logged at 2,168 ft. Pay was drilled between 2,174-75 ft. Well pumped only 6 bbl. of oil and 59 bbl. of water natural in 24 hours.

DuLong Oil Co. was testing an oil pay logged 300 ft. in the Traverse at a South Adams field well, Arenac County. This is the first well in this area to show for possible commercial completion at this point. Other producers in South Adams are completed either in the upper Traverse or in the Richfield. New well is the DuLong G-1 Gordon, S½ SW NE 34-19n-3e, Adams Township. Top of Traverse lime was picked at 2,050 ft. Oil pay was drilled between 2,340 ft. and total depth, 2,350 ft. Pay was drilled before up-hole water was cased off. Fluid level dropped 300 ft. as pay was drilled. Well flowed 100 bbl. of fluid to tanks in 5 hours before casing was run. After casing was set, next test showed 115 bbl. of fluid in 2½ hours. About 40 per cent of total fluid is water, part formation water and part encroachment water. Additional testing is in progress.

EASTERN INTERIOR

WESTERN KENTUCKY

In Henderson County George Hoffman et al. 1 Russell-Keach Unit in 19-O-24 is swabbing and flowing 14 bbl. of oil per hour, or at the daily rate of 336 bbl. Production is from the Aux Vases lime at 2,450-58 ft. after acidization. The new discovery well is 2,400 ft. from Robards field, and 1 mile northeast of the town of Robards.


Big Oil Find Reported
North of Leduc Fields
EDMONTON, Feb. 13 (CP) — A new major oil find was announced today, ninth anniversary of the now-famous Leduc discovery of 1947.
On Feb. 13 of that year Imperial Oil Ltd., brought
claims, which is continuing, was described as the biggest "oil rush" in the history of northern Alberta.
The northern discovery was made by Imperial

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While the Bank is prepared to provide all available information on the oil industry, it does not make recommendations regarding the purchase of individual oil stocks.

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INDIANA

In Posey County, 4 miles west of Mount Vernon in NE SW SE 4-7s-14w, Coy Oil Co. set casing at the 1 J. S. DeHaven for McClosky lime tests at 2,831-34½ ft. The well recovered 135 ft. of clean oil, 105 ft. mud-mixed oil, no water, on test at this depth. The drill-stem test was of 2-hour duration.

ILLINOIS

In Marion County McKelvy and Sipoha 1 Heinzman, N½ NE NW 32-4n-1e, southwest of Patoka, pumped 12 bbl. of oil per hour from the Trenton lime at 3,948-95 ft. This well is 6 miles from Trenton production.

SOUTH TEXAS

GULF COAST

New Pay Zones Opened In Orchard-Barb-Mag Area

The Orchard (Moore's field)-Barb-area of Fort Bend County accounted for two discoveries last week.

Sun Oil Co. got a small gas well in its 1 Aylor, 1½ miles northwest of Orchard production, and about 2 miles west of the newly developing Barb-Mag field. It opens a new, relatively shallow sand, perforated at 3,140-64 ft.

At the new Barb-Mag field, The Texas Co. completed its 2 Sliva as a new-pay oil discovery. Production is from the first Yegua FB-11 sand, perforated at 8,216-24 ft. Flow was 194 bbl. of 39.5°-gravity oil per day through 5/32-in. choke with pressure of 1,000 psi. and gas-oil ratio of 355 cu. ft. per barrel. Hole was drilled to 8,600 ft.

Russell McGuire has a new well at Barb-Mag with completion of his 7 Moore, productive from the field's 8,350-ft. sand, perforated at 8,343-47 ft. Flow was 60.60 bbl. of 39.6°-gravity oil per day through 9/64-in. choke.

SOUTHWEST TEXAS

Dimmit County Records Two New Gas Discoveries

Pronto Drilling Co. has completed two new Olmos-sand gas discovery wells in the Carrizo Springs area of northwestern Dimmit County.

Its 1 Lora Stewart and others, in GWT&T Survey 653, 4 miles northwest of Carrizo Springs, got an open-flow potential rating of 3,500,000 cu. ft. of gas per day with pay at 2,395½-2,401½ ft., total depth 2,675 ft. It is southeast of the old Carrizo Springs field.

Its 1 Caroline Green Cook, in I&GN

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OCTOBER 18-21

Aerial view of show grounds showing completely enclosed exhibit buildings and a section of the exhibit grounds. Note Boom Town Rig in foreground.

The 1956 show will again be presented at Fair Park, 42nd and Andrews Highway, Odessa, Texas. Exhibit buildings have improved. An additional 56,000 square feet of floor space has been added.

Contracts for exhibit space are now ready and reservations are being accepted. Contracts to previous exhibitors will be mailed this month.

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Survey 26, 3½ miles southwest of Carrizo Springs, is good for 1,100,000 cu. ft. per day, open flow, with pay at 2,382½-88½ ft., total depth 2,772 ft. It is west of Wintergarden production and north of McKnight field.

SOUTH LOUISIANA

Shallower Pay Produces In Deep Field at Rayne

Another productive zone, about 1,000 ft. shallower than any other in the field, has been opened at Rayne, eastern Acadia Parish.

Discovery well was drilled by Warren Petroleum Corp., with General Gas Corp. as joint owner. It is their 1 Navarre Unit, which produced at the rate of 3,250,000 cu. ft. of gas and 233 bbl. of condensate per day through chokes.

Pay was logged at 10,830-82 ft., and is open through perforations at 10,830-82 ft. Hole was drilled at 13,302 ft.

The well's pressure was 4,000 psi., flowing, and 4,750 psi., shut in. Gravity of the fluid is 54°.

Woodland Extension Well Opens New Producing Sand

An extension well on the east flank of Woodlawn field is being completed as one of the field's best producers and opens a new pay zone in the lower Hackberry section.

It is Delhi-Taylor Oil Corp.'s 1 Trimble, in 7-9s-5w, which, in a preliminary test through drill pipe and a 5/32-in. choke, flowed at the rate of 512 bbl. of 38°-gravity oil per day.

The new pay is perforated at 10,278-10,305 ft. The well is on a Union Oil & Gas Co. farmout agreement.

Second Lake Field Opened Near New Orleans Airport

Shell Oil Co. has a new gas-condensate discovery well in the southwestern part of Lake Ponchartrain, St. Charles Parish. It is about 2 miles offshore from a point about 4 miles northwest of New Orleans' Moisan airport, northwest of the city.

The discovery well is its 1 State Lease 2918, in Block 41. It was drilled to 10,981 ft., but is productive from a casing-perforated interval at 8,808-24 ft. Tested through ⅛-in. choke, it flowed at the rate of 1,680,000 cu. ft. of gas daily, spraying condensate. Pressure was 3,375 psi.

Location of the discovery is in about 12 ft. of water. Shell's second test is about ½ mile east.

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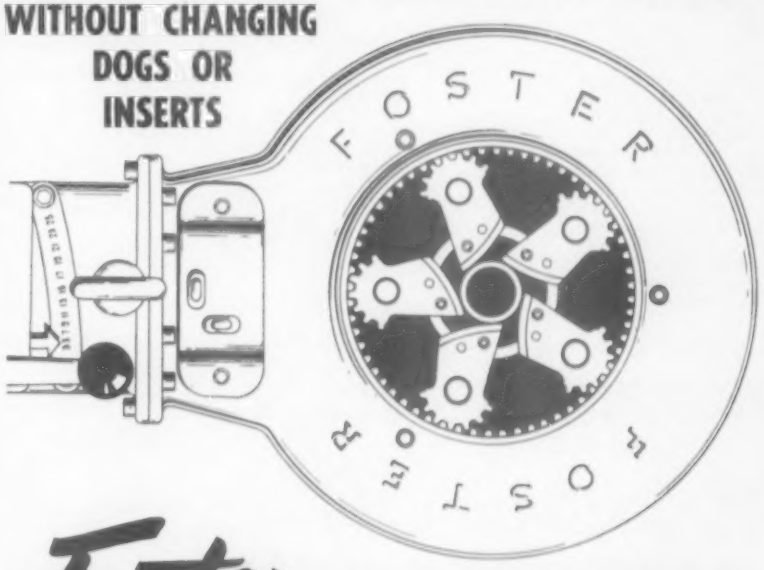

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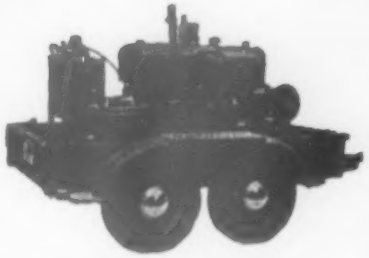

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Stanolind Oil & Gas Co. reported discovery of oil in the Granite Wash at its 1 West Giroux Lake wildcat, 6¾ miles southwest of the initial discovery in the area. Two of four wildcats in the Whitecourt region are testing; the third is nearing testing depth. One is Hudson's Bay 1 Beaver Creek, one is Phillips A-1 Pleasant, the third is Imperial 6-36 Virginia Hills, and the fourth is Fina et al., 11-6 Oldman.

WESTERN CANADA

ALBERTA

Drilling Interest Shifts To the Whitecourt Area

The Whitecourt region in northwestern Alberta is front-row-center on the exploratory scene in western Canada. Four areas inside the Whitecourt region hold the spotlight . . . Beaver Creek, Pleasant, Virginia Hills, and Oldman.

Beaver Creek . . . Hudson's Bay Oil & Gas Co., Ltd., 1 Beaver Creek, LSD 1, 32-56-19w5, is an indicated discovery in the D3 Devonian. Late in April the same well found 10,600 to 12,800 M.c.f. of gas per day on test of the D1 zone at 11,060-11,100 ft.

Pleasant . . . The Phillips Petroleum Co. A-1 Pleasant wildcat on LSD 2, 29-60-10w5, 27 miles northeast of the 12-36 Windfall discovery well is a gas discovery according to reports. Production is from the Mississippian. April tests credited the well with 6,000 M.c.f. of gas per day with distillate and oil spray.

Virginia Hills . . . The Virginia Hills wildcat, Imperial 6-36, LSD 6, 36-63-12w5, is drilling below 6,320 ft. It is located 30 miles northeast of 12-35 Windfall, and 22 miles northwest of the A-1 Pleasant wildcat.

Oldman . . . Fina et al's 11-6 Oldman, LSD 11, 6-59-15w5, is 5 miles southwest of the follow-up discovery at Windfall. The well was drilling below surface casing at late April reports, but drilling has stopped for fuel and supplies.

No. 2 at Giroux Lake

The second oil discovery at Giroux Lake in northwestern Alberta is reported at a Stanolind Oil & Gas Co. wildcat, the West Giroux Lake Crown No. 1, LSD 10, 17-65-21w5. This Granite Wash discovery is 6¾ miles southwest of the discovery well at Giroux Lake, also a Granite Wash oil strike. Recovery on test was 3,800 ft. of clean oil. Location is 65 miles southwest of High Prairie and 80 miles southeast of Grande Prairie.

Tennessee Records Viking Gas Discovery

Gas in indicated commercial volume has been discovered by Tennessee Gas Transmission Co. in the Viking sand at a wildcat in the Control district of southeastern Alberta. The new strike, Tennessee Gas Transmission-Mobil C.P.R. 5-1 Hutton, on LSD 7, 5-24-15w4, recorded a gas flow of almost 3,000 M.c.f. daily during initial test in the Viking horizon. The well is 7 miles east-southeast of a previous gas discovery well drilled by Mobil Oil of Canada, Ltd.

Initial test in the zone was run of the interval 2,770 to 2,805 ft. with valve open 36 minutes and shut in 30 minutes. Gas flowed to surface in 1 minute and reached a maximum flow rate of 2,900 M.c.f. daily. When the pipe was pulled it contained 300 ft. of salt water. Second test, from 2,830 to 3,870 ft., with valve open 60 minutes gave 2,460 ft. of salt water, 60 ft. of gas-cut mud and 120 ft. of muddy salt water. While the third test yielded 2,704 ft. of salt water from the interval 2,904-44 ft. Valve was open 60 minutes and shut in 30 minutes.

Oil Show Reported At Carbon Area Test

An oil show at a discovery well in the Carbon district of southern Alberta was recorded at the Shell Oil Co. A-7-33 Carbon well on LSD 7, 33-29-22w4,

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about 55 miles northeast of Calgary. It is 3½ miles east of the Shell A-7-31 Carbon, completed gas success and 1½ miles northeast of another Shell gasser, its A-7-29 well.

During a drill-stem test of the interval 4,697 to 4,867 ft. with the valve open 105 minutes there was a good air blow and gas rose to surface in 75 minutes at a rate too small to measure. There was a recovery of 270 ft. of heavy oil and gas-cut mud (15 per cent oil) and 60 ft. of muddy gas and oil. Further tests will be conducted to evaluate the possibilities of commercial oil production.

PACIFIC COAST

CALIFORNIA

Gatchell Production Extended At Guijarral Hills

Gatchell sand production in the Polvadero area of Guijarral Hills field was extended almost 1 mile east with completion of the 11,339 ft. 58-36 Helm Co.-Sumpf-Bourdieu by Los Nietos Oil Co. The operator found the Eocene age Gatchell between 10,654-11,332 ft. The extension was completed for 1,263 bbl. daily of 29.9°-gravity crude through a 74/64-in. choke. The perforated intervals are 11,046-11,131 ft. and 11,144-11,314 ft.

Oxnard Hopes Wan

Optimism for possible oil production within the city limits of Oxnard, Ventura County, waned with unfavorable reports on Richfield Oil Corp's 1 Ruggles. This is the first test to be drilled under the city limits since a recent ordinance permitting such operations was passed. The drill site is on the south edge of town. Company engineers are reportedly pondering whether the slight shows encountered during drilling warranted setting costly casing for test purposes. Meanwhile, the well was drilling ahead below 12,022 ft.

New San Mateo Wildcat Project Planned

Neaves Petroleum Corp. announced plans to drill a wildcat in the La Honda area of San Mateo County on a farmout from Union Oil Co. Drillsite for this test is approximately 10 miles northwest of Union's Oil Creek discovery. Probable objective is the lower Purisima which outcrops in the region. This structure has yielded small quantities of high gravity crudes in the past but no sustained production has been developed from it in the La Honda area.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Gaines County Devonian Strike Ready to Complete

David Fasken 1 Jones, north of Russell-Devonian field in northwestern Gaines County, flowed from 33-50 bbl. of oil an hour on production tests, then was shut in for storage and completion.

Sample top on the Devonian was 11,151 ft., minus 7,543 ft. Initial test at 11,155-87 ft. had oil in 2 hours and 15 minutes. The flow into pits was estimated at 50-60 bbl. an hour.

Perforations were made from 11,151-72 ft., washed with 500 gal. of mud acid, after which it kicked off to flow 33 bbl. an hour through ⅜-in. choke. Flowing pressure was 270 psi. and gas-oil ratio was 450:1.

Location is in Section 31, Block AX, PSL Survey, 12 miles southwest of Denver City and northwest of Russell field.

Andrews County connecting well . . . Sinclair Oil & Gas Co. 2 University "212," 30-9-ULS, has been completed for 2,010 bbl. of oil a day.

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COLORADO

Washington County: Vaughey & Vaughey 1 Hubbird, C NE SW 24-1s-56w. IPP 29 BO, 11 BWPD, "D" sand discovery, new field. TD 5,189 ft. "J" sand.

J. W. Braden 1 Hanley, C SE SW 23-3s-56w. IPP 245 BOPD, "J" sand discovery, new field. TD 5,147 ft. "J" sand.

ILLINOIS

Bond County: Murvin & Steber 1 Ackerman, NE NW NE 7-6n-4w. IPP 12 BOPD, Devonian sand 1,876-90; 1,910-20 ft. TD 2,706. (Opens West Sorento pool).

F. L. Strickland 3 Eisworth, NW NW SE 33-6n-4w. IPP 65 BOPD, Devonian sand 1,921-23 ft. TD 1,923 ft. (Opens South Sorento pool).

INDIANA

Vermillion County: W. C. Cook 1 O. & S. Ponton, NE SW SE 3-15n-9w. IPP 30 BOPD, Devonian 1,216½-37 ft., 38.5°-gravity oil. TD 1,237 ft. (Discovery of Montezuma field).

KANSAS

Barber County: West Medicine Lodge pool was opened at Musgrove Petroleum Co. 1 McGrath "A," SW SW NW 16-33s-14w. Completing as a Mississippian gas discovery. TD 5,230 ft.

Barton County: South Bissell Point pool was opened at Thunderbird Drilling Co. 1 Wood, SW NW SE 15-19s-13w. Completing in the Arbuckle. TD 3,438 ft.

Reimer pool was opened at Oil Capitol 1 Reimer, NE SE NW 25-17s-15w. IP 53 BOPD, Lansing. TD 3,577 ft.

Cowley County: Albright pool was opened at H&M Drilling Co. et al 1 Albright, SE SE NE 3-34s-5e. Completing in Mississippian. TD 3,136 ft.

Decatur County: Warner pool was opened at Cities Service Oil Co. 1 Warner "E," NE NE SW 11-1s-27w. IP 330 BOPD, Lansing. TD 3,530 ft.

Ellis County: Engel pool was opened at Colorado Oil & Gas Co. 1 Engel, NE SE NW 34-14s-18w. Completing in Lansing and Arbuckle. TD 3,625 ft.

Wagner pool was opened at Petroleum Mgt. et al 1 Wagner, NW NW SW 36-14s-16w. Completing in Lansing. TD 3,577 ft.

Ellsworth County: Hoch pool was opened at Birmingham-Bartlett 1 Hoch, SE NE NW 19-15s-10w. Waiting on potential from Arbuckle. TD 3,305 ft.

Marion County: Southeast Antelope pool was opened by Hover and Hodson 1 Loveless, SE SE NE 2-19s-4e. IP 15 BOPD, Mississippi. TD 2,345 ft.

McPherson County: Round Hill pool was opened by Greenland Drilling Co. 1 Johnson, SW SW SW 28-18s-1w. IP 25 BOPD, Cherokee. TD 2,841 ft.

Ness County: Brownell pool was opened at Welch and Olsson 1 Walker, NW NW SE 23-16s-22w. Completing in Cherokee. TD 4,400 ft.

Cruce pool was opened by Barnett Oil Co. at 1 Ward, SE SE SE 4-19s-26w. Completing in Mississippi. TD 4,561 ft.

Rice County: North Orth pool was opened at

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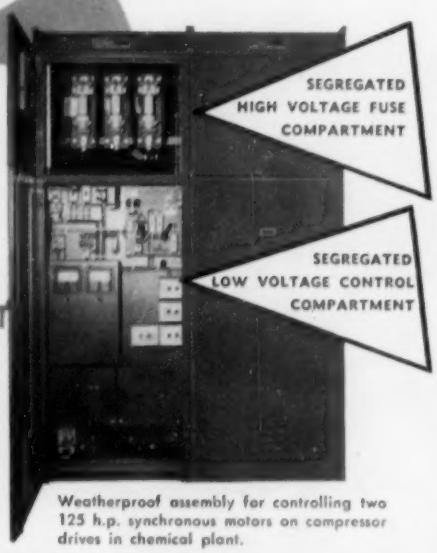

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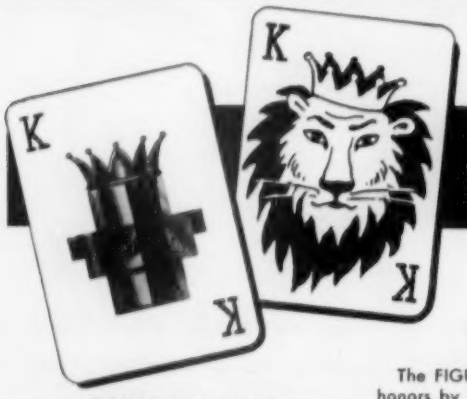

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Iron Drilling Co. 1 Boldt, SE NE NW 23-18s-10w. Completing in Arbuckle. TD 3,270 ft.

Sumner County: Beatie pool was opened at Gulf Oil Corp. 1 Beatie, NE NE NE 21-31s-2w. Completing in Simpson. TD 4,300 ft.

Thomas County: Kindig pool was opened at Bachus Oil Co. and Veeder Supply 1 Kindig, NE NE NE SE 30-8s-32w. Completing in Cherokee. TD 4,718 ft.

Trego County: Rhoden pool was opened at Imperial Drilling Co. Rhoden "A," SW SW NE 24-12s-23w. Completing in Lansing. TD 4,160 ft.

KENTUCKY

Henderson County: Slagter Production Co. 1 King, NW SE NE 13-P-22. IPP 13 BOPD, Waltersburg sand 1,749-52 ft. TD 1,752 ft. (Opens North Corydon pool in Illinois basin).

SOUTH LOUISIANA

Assumption Parish: Union Oil Co. of California 1 Aristile Landry, 33-15s-14e. IP 390 BOPD, 9/64-in., 36°, perforations 12,666-73 ft. TD 14,370 ft. (New pay and extension in Amelia field.)

Calcasieu Parish: E. Cockrell, Jr., 1 Hazzard, 35-10s-9w. IP 1,312 M.c.f. daily, 6/32-in., dry gas, perforations 3,790-92 ft. TD 10,239. (New field.)

Quintana Petroleum Corp. 1 Williams et al., 5-10s-9w. Shut-in gas well, no gage, perforations 9,403-15 ft. TD 9,830 ft. (New pay in North Lockport field.)

Quintana Petroleum Corp. 1 Maplewood, 6-10s-9w. Shut-in gas well, no gage, perforations 9,667-79 ft. TD 9,953 ft. (New pay in North Lockport field.)

Plaquemines Parish: California Co. 3 Calco-Shell-State Lease 2127. IP 69 BOPD and 1,755 M.c.f. daily, 5/32-in., 40.8°, perforations 8,621-33 ft. TD 8,750 ft. (New pay in West Black Bay field.)

St. Charles Parish: John W. Mecom and Freeport Sulphur Co. 2-A Waterford, 17-15s-21e. IP 107 BOPD, ¼-in., 28°, perforations 5,532-56 ft. TD 12,029 ft. (New field.)

St. Mary Parish: Humble Oil & Refining Co. 1 Federal O.C.S. 0466, Blk. 77, Eugene Island Area, Gulf of Mexico. IP 132 BOPD and 5,579 M.c.f. daily, ¼-in., 49.6°, perforations 14,500-30 ft. TD 15,491 ft. (New offshore field.)

Vermilion Parish: Richardson & Bass 1 Amerada-Maxie Broussard et al. 8-12s-3e. IP 56 BCPD and 1,909 M.c.f. daily, 7/64-in., 50.4°, perforations 11,920-24 ft. TD 16,250 ft. (New pay in Abbeville field.)

MICHIGAN

Ottawa County: Miller Brothers 1 Siemion, NE SE SW 3-7n-15w. IPP 9 BOD, 30°, Dundee 2,029 ft., Dundee-Monroe pay 2,100-10 ft. TD 2,110 ft. (New pool.)

MISSISSIPPI

Adams County: Hunter Jones and Jett Drilling Co. 2 Armstrong, 33-5n-2w. IP 98.3 BOPD, ⅛-in., 39°, perforations 6,602-05 ft. (Wilcox). TD 7,010 ft. Elev. 76 ft., Wilcox 4,696 ft., base Baker shale 6,459 ft. (New field—Southeast Ellislie).

Jefferson County: Midstates Oil Corp. and G. H. Jett 1 Wood (no section)-10n-1w (directional hole under Mississippi river). IP 155 BOPD, ⅛-in., 38.9°, perforations 9,292-96 ft. (vertical depth, in Tuscaloosa-Massive sand). TD 9,380 ft. (drilled), 9,337 ft. (vertical). (Extends Louisiana's Rodney Island field into Mississippi—new field for Mississippi).

NEBRASKA

Kimball County: Maxey Drilling Co. et al. 1 Kreizinger, SW SW SE 20-13n-55w. IPP 100 BOPD, "J" sand discovery, new field. TD 6,565 ft. Skull Creek.

SOUTHEAST NEW MEXICO

Eddy County: Kincaid & Watson 1-8 Humble-State, 8-17s-29e. IP 70 BOPD, 35°, pay 2,383-3,402 ft. TD 2,427 ft.

Lea County: Signal Oil & Gas Co. and Standard Oil Co. of Texas 1 Kelly-State, 35-15s-37e, 10 mi. NE Lovington. IP 1,944 BOPD, 8/64-in., natural flow, TP 1600 psi., GOR not reported on potential, top Devonian 12,844 ft., top pay 13,030 ft. TD 13,111 ft., elev. 3,766 ft.

OKLAHOMA

Beaver County: O. H. Parker 1 Mitchell, 5 miles southwest of Northwest Hibbs in C SE NW 3-1n-23eCM. IPP 8 BDPD, 20,300 M.c.f. of gas per day. Morrow sand 7,634-44 ft. TD 8,275 ft. (Gas-distillate discovery in Hugoton embayment of Anadarko basin).

Caddo County: Amerada Petroleum Corp. 2 Young, SE NE SW 19-6n-10w. IP 7,160 M.c.f. of gas per day. Wade sand 7,056-7,130 ft.; 8,900 M.c.f. of gas per day, Marchand 8,176-8,342 ft. TD 8,575 ft. (Gas discovery in Anadarko basin).

Grant County: Provincial Oil Co. 1 Needham, 2 miles northwest of West Prairie Center in NE NE SE 31-25n-3w. Pumped and flowed 150 BOPD, lower Layton sand 4,400-4,435 ft., 41°. TD 4,435 ft. (Oil discovery on northern basin shelf).

Woods Petroleum Co. 1 Johnson, 3½ miles east of Northwest Round Hill in NW NW SE 16-28n-7w. IP 7,500 M.c.f. of gas per day, Bartlesville-Penn sand 4,792-4,808 ft., 24/64-in. choke. TD 4,934 ft. (Gas discovery on Cherokee trend).

Kingfisher County: Tennessee Gas Transmission Co. 1 Oltmans, 2 miles west of West Lovell (abd) field in NE SW NE 24-18n-5w. IPF 241 BOPD, lower Layton sand 5,396-5,418 ft., 41.3°, 18/64-in. choke. TD 6,132 ft. (Oil discovery in remote area of Anadarko basin).

Osage County: Shamrock Oil & Gas Co. 1 Osage, 2½ miles northeast of abandoned production in SE SE SE 18-28n-6e. IPP 16 BOPD, Mississippi chat, 3,045-49 ft., 34°. TD 3,122 ft. (Oil discovery on Northeast Oklahoma platform).

Tillman County: S. D. Johnson 1 Gibson, 1½ miles northwest of South Frederick pool SW SW SW 24-2s-18w. IPF 156 BOPD, Strawn conglomerate 5,012-37 ft., 16-/64-in. choke. TD 5,122 ft. (Oil discovery in eastern end of Palo Duro basin).

WEST TEXAS

Pecos County: Great Western Drilling Co. 1 Walker, 13-3-H&TC, 1 mi. E Imperial. IP 720 BOPD, 20/64-in., TP 680 psi., GOR 923, 40°, Waddell sand perforations 5,987-6,000, 6,008-26 ft., natural completion. TD 6,584 ft., elev. 2,391 ft.

WEST CENTRAL TEXAS

Comanche County: Weeks & Jay Production Co. 1 Lindley, Wm. Demoss Sur., 6 mi. SE Gorman. IP 97 BOPD, 13/64-in., TP 65 psi., 45°, GOR 500, Caddo lime 2,642 ft. TD 2,935 ft. Suggested field name, Lindley-Caddo.

Haskell County: Crown Central Petroleum Corp. 1 Herren, P. H. Anderson Sur.,

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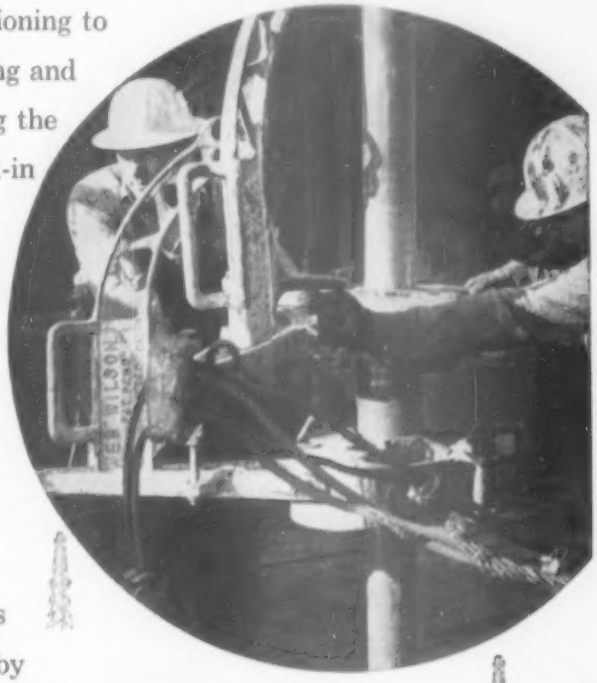

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A-3, 6 mi. NW Haskell. IP 162 BOPD, 20/64-in., TP 600 psi., GOR 518, 37°, Strawn sand 4,786-95 ft. TD 5,850 ft.

Shackelford County: Laramore Oil Exploration Co. 1 Dillingham, Sec. 554, TE&L Sur., 9½ mi. N Albany. IPP 45 BOPD, 38°, GOR zero, Cook sand 807-812 ft. TD 812 ft. Le Clair Operating Co., Inc. 1-E Hooker Trust, 22-11-T&P, 2 mi. SW Albany. IP 102 BOPD, open 2-in. tubing, TP 80 psi., GOR 1500, 41°, Mississippian lime 4,737-49 ft. TD 4,749 ft.

NORTH TEXAS

Clay County: L. T. Burns 1 Coker, Blk. 25, Freestone CSL, A-144, 2 mi. NW Newport. Previously completed dry at 4,098 ft. IPP 76 BOPD, 42°, GOR 382, Bryson sand 4,079 ft. TD 4,098 ft. New field name, Newport NW-Bryson.

Clay County: A. R. Dillard 1 Sanzanbacher, Sec. 12, Calhoun CSL, 4½ mi. E Bluegrove. IPP 77 BOPD, 41°, GOR 150, pay 4,796 ft. TD 4,809 ft.

Grayson County: Samedan Oil Corp. 1 Noland, A. McKinney Sur., A-779, 1 mi. N Macomb. IPP 54 BOPD, GOR rezo, Strawn 4,584-96 ft. TD 5,601 ft.

Grayson County: Nortex Oil & Gas Corp. 1 McMenamy, R. V. Banks Sur., A-72, 2¼ mi. S Whitesboro. IPP 101 BOPD, 28.6°, pay 2,122 ft. TD 2,250 ft. New field name, McMenamy "K" Lime.

Jack County: Paul Steed 1-A Caddell, S. H. Hughes Sur., A-1689, 7 mi. SW Jacksboro. IP 144 BOPD, 18/64-in., TP 125 psi., GOR 438, 40°, Lower Strawn 3,376-88 ft. TD 3,388 ft.

Young County: Anderson Oil, Ltd., & Associates 2-A Dorian King, TE&L Sur. 16, A-292, 3 mi. SW Newcastle. IP 128 BOPD, 14/64-in., 43°, TP 280 psi., GOR 500, pay 3,949 ft. TD 3,955 ft.

EAST TEXAS

Anderson County: Clardy & Barnett 1 Turner, W. R. Wilson Sur., A-66, ½ mi. N Slocum. IP 262 BOPD, 12/64-in., TP 825 psi., GOR 848, 39°, Sub-Clarksville pay 5,664 ft. TD 5,667 ft. Suggested new field name, Slocum Edmondson.

Angelina County: Sam Trant 1 McKnight, Joseph Durst Sur., A-201, 2½ mi. N Pollock. IP 790,000 cu. ft. gas, plus 15 bbl. condensate per 1,000 cu. ft., TP 750 psi., top Pettet pay 10,280 ft. TD 10,704 ft. Elev. 290 ft.

Red River County: Don Fitzwater 1 Cole, Whitfield Moore Sur., 15 mi. NE Detroit. IPP 20 BOPD, 15°, Paluxy 1,769 ft. TD 1,786 ft.

TEXAS PANHANDLE

Ochiltree County: M. A. Machris 44-141 P. A. Harbaugh, 22 miles S of Perryton, 1 mile SW of gas produtcion in Sec. 141, Blk. 93, T&NO Sur. IPF 245 BOPD, Morrow sand 8,702-26 ft. TD 8,778 ft. (Oil discovery.)

TEXAS GULF COAST

Bee County: Joe Bailey Oil Co. 1 Dugat Unit 1, Anna Burke Sur. (1 mile southeast of Beeville). IP 6,600 M.c.f. daily, open-flow potential, dry gas, perforations 3,452-69 ft. TD 3,750 ft. (New field).

Bee County: W. B. Cleary, Inc., and James H. Helland 1 Hutchinson, Anna Burke Sur., A-5. IP 15,000 M.c.f. daily, open-flow potential, dry gas, perforations 3,476-82 ft. TD 3,538 ft. (New field.)

J. M. Ponder et al. 2 Seger, George O'Docharty Sur., A-49. IP 12,250 M.c.f. daily, open-flow potential, dry gas, perforations 2,833½-25½ ft. TD 4,175 ft. (New field.)

Fort Bend County: Sun Oil Co. 1 Aulor, Gail Borden, Jr., Sur., A-12. Shut-in gas well, no gage, perforations 3,140-64 ft. TD 9,250 ft. (New pay in Orchard field.)

Live Oak County: David Muss 1-A Cartwright, F. Botillo Sur. Shut-in gas well, no gage, perforations 2,942-45 ft. TD 4,620 ft. (New field.)

SOUTHWEST TEXAS

Dimmit County: Colton & Colton and Kirkwood & Morgan 1-A Bradshaw, T&NO Sur. 15, A-776. IP 65.11 BOPD, 9/64-in., 40°, perforations 2,674-78 ft. TD 3,100 ft. (New pay in Winter Garden field.)

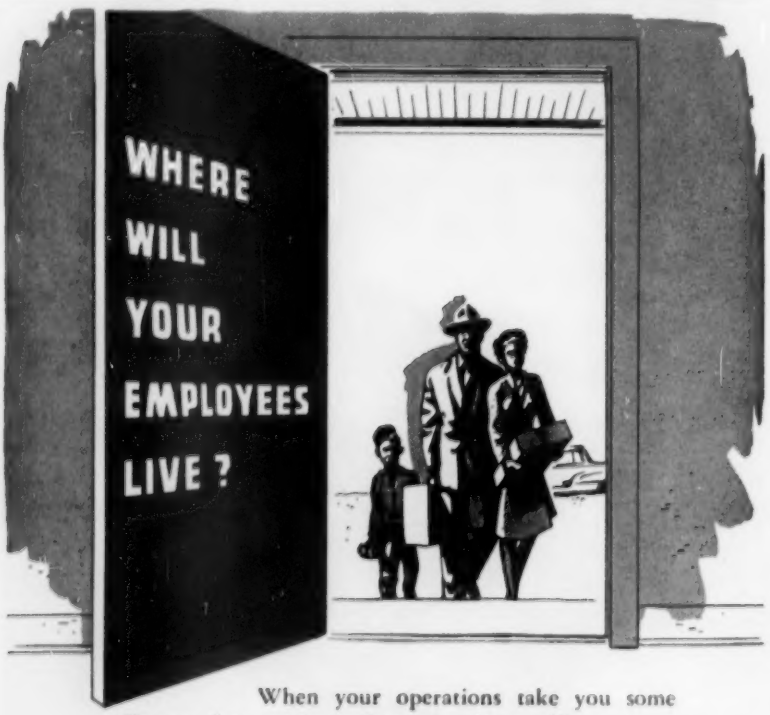
Duval County: La Gloria Oil & Gas Co. 1-C Dinn, AB&M Sur. 440, A-1855. IPP 45.43 BOPD, 44.6°, perforations 3,540-45 ft. TD 3,614 ft. (Extends Elva field 1 mile northeast.)

Hidalgo County: Bettis & Shepherd 1 Slavik, Tract 26, Blk. 11, San Juan Plantation Subd. of Porcions 71 and 72. IP 8,600 M.c.f. daily, open-flow potential, GOR 84,750 cu. ft. per bbl., 53.8°, open-hole 8,150-71 ft. TD 8,171 ft. (New field.)

La Salle County: Shell Oil Co. 1 Mathews, I&GN Sur. 2, Blk. 4, A-328. IP 67.05 BOPD (net), 48 per cent water, 32-in., 37.7°, perforations 5,008-15 ft. TD 10,742 ft. (New field—Woodward.)

WYOMING

Natrona County: M. F. Lewis 2 Government, SE SW NE 27-40n-80w. IPP 70 BOPD, Stray sand, new field discovery well. TD 975 ft.



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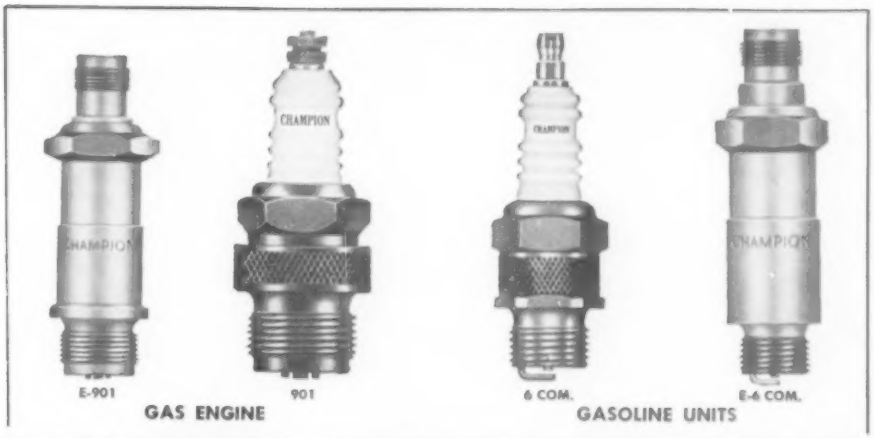

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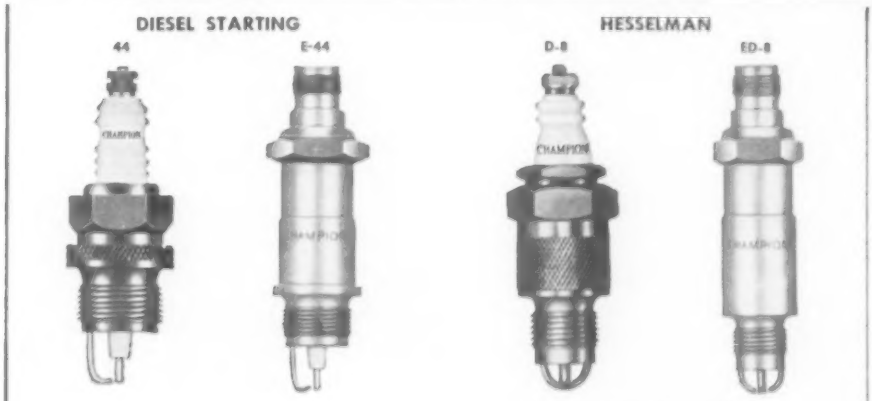

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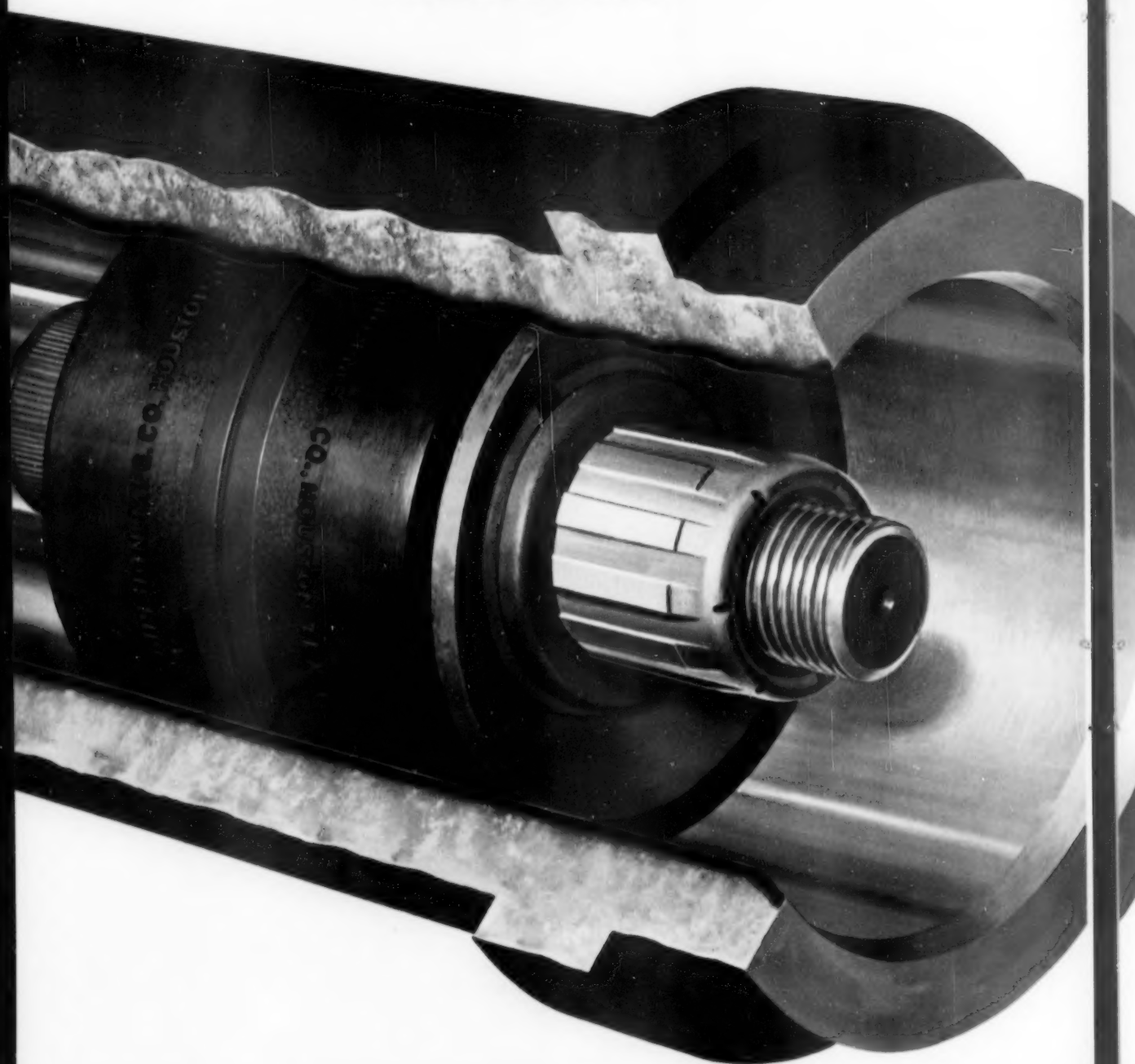
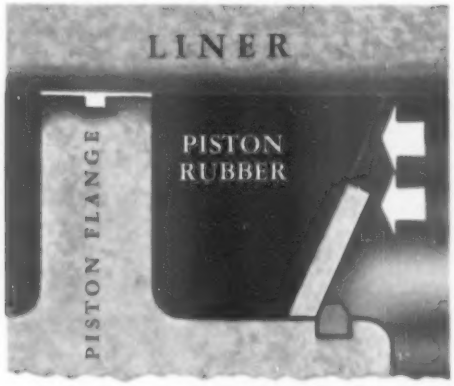
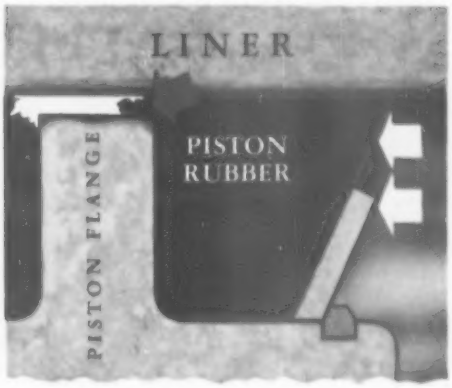




When liner and piston flange fit closely, pressure can not extrude rubber into the clearance to be pinched off. A close fit between piston and liner eliminates the main cause of piston failure and greatly extends piston life.



An important cause of piston failure is excessive clearance between the piston flange and liner. When pump is operating, pressure forces a part of the piston rubber between the space where it is pinched off. This action seriously shortens piston rubber life.

Authorities agree that excessive clearance between piston flange and liner is the chief reason for piston rubber failure. Realizing this, we have taken all practical steps *with both Mission Pistons and Liners* to keep this clearance as low as possible as long as possible. Here are some of the things we do:

Mission Piston flanges are machined to extra close tolerances to keep initial clearances low. We provide a wear groove in the flange so you can tell at a glance when it is time to change the body. To reduce the rate of wear, we induction harden the flange. Finally, we give the flange a special treatment to prevent galling.

Mission Liners are first machined to extremely close tolerances. Then we give the alloy steel an induction hardening treatment that results in a hard, uniform, wear resistant bore. We also "*Satin Finish*" the liner bore to reduce the initial rate of wear of both piston and liner.

Mission Pistons will give outstanding service in any make of liner, and Mission Liners will do a good job with any make of piston, but for long, trouble-free service, you can't match the combination of Mission Pistons running in Mission Liners. Both Mission Pistons and Mission Liners are guaranteed to give satisfactory service or your money is refunded. You can't lose, so order them both the next time you go to your supply store. You will be pleased with the results.

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McCullough Log Enables Precision Perforating of 5′ Pay Zone

Discovers 8′ Error in Electric Log and Casing Measurements

Operator of this old well ran an electric log which located a new, possibly productive, 5′ sand.

McCullough was then called to run a Neutron Log. The Neutron curve confirmed the productive possibilities of the new zone, but also discovered that both the electric log and casing measurements were 8′ in error.

The well was plugged back to 6800′ and perforated according to McCullough measurements.

Thirty ½" improved Ogival Bullets were shot in the 5′ sand in one run by a 3⅛" O.D. McCullough M-3 Gun. Casing was 5½" O.D. 17 lb.

The well started flowing through the casing before the M-3 Gun was out of the hole.

If the McCullough Radiation Well Logger had not discovered the 8′ measurement error, the 30 shots would have missed the pay zone entirely.

It always pays to rely on the accuracy and dependability of McCullough's Radiation Well Logger.

McCullough Log Locates and Defines 11 New Pay Zones

Accuracy of McCullough Radiation Well Logger Permits Sharp Shooting of 11 Thin Zones for 138 B/D Increased Production

This was an old well in an established California oil field. Production had fallen to five barrels of oil per day.

Believing better production was possible, the operator decided to log and re-perforate the well. McCullough's combination Gamma Ray-Neutron Log was run from 4380′ to 5645′, locating several small, promising stringers of untried sands above the original pay zones.

A simultaneous collar log accurately located casing collars in relation to these thin sands, thus assuring "pin-point" accuracy in perforating.

The two original producing sands were re-shot, four holes per foot, with 26 improved ½" Ogival Bullets from McCullough M-3 Guns and with 26 McCullough Standard Casing Glass Jets.

Above these zones were the 11 small sand stringers ranging in thickness from 4 feet to 13 feet. Intermediate zones, lying between the productive sands, which were not to be perforated ranged in thickness from 5 feet to 103 feet.

Accurate measurement means "putting the shots where they count"... and the "pin-point" accuracy of the McCullough Radiation Well Logger makes sharp shooting of thin zones practical... assures uniform perforating coverage of any zone, thick or thin.

The 11 pay sands were perforated with 256 shots, four holes per foot, by 3½" O.D. McCullough M-3 Perforators firing ½" Ogival Bullets. Production increased from 5 to 143 barrels of oil per day.

This is only one of many actual jobs where the accurate, reliable, easily interpreted information provided by the McCullough Radiation Well Logger has located and defined multiple pay zones, tied-in casing collar locations and permitted precision perforating for best possible production.

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By taking nothing for granted . . .

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BUY an oil-producing property, operate it more efficiently and economically, and hike its production.

That's Marion H. Stekoll's formula for making money in the producing end of the oil business. He feels it's one of the few ways left for a small company to grow amidst today's high costs and fierce competition.

Stekoll is president of the 30-year-old Stekoll Petroleum Co., Dallas.

The firm was formed by his father, Harry Stekoll, a Latvian political refugee who came to the United States in 1914, built up a thriving pipeline business in Tulsa, and entered the production end in Oklahoma and Borger, Tex., in 1926.

The younger Stekoll was born in Tulsa in 1916 and has practically lived oil. He helped pull rods for his father near Borger when he was 11, and worked in the field each summer during his school years. He was graduated from Stanford University in 1937 as a petroleum engineer.

After 3½ years with Core Laboratories, Dallas, he resigned in 1942 to join the elder Stekoll as a partner in Stekoll Petroleum. He became president in 1951.

Theories pay off . . . Marion Stekoll, now 40, successfully tested his operational ideas in two of the oldest oil pools in the middle United States. These were Bolton, a 58-year-old field near Independence, Kans., and Corsicana Shallow, Texas' oldest commercial field (62 years) in Navarro County.

Bolton was considered by most companies in the area, including some large ones as being unfloodable. Stekoll flooded it and has recovered to date well over 2,000,000 bbl. of oil.

He has drilled roughly 450 input and producing wells to Bolton 1,000-ft. pay sand and still has about 100 producing wells in the field. Engineering innovations which he pioneered in this field have become common practice in many others.

Stekoll, in Bolton, was the first to use 2-in. line pipe as casing—the ultra-slim hole for shallow production. He pumped these wells with 1-in. line pipe. He killed another engineering assumption held generally in the industry by flowing the majority of the water-flood producers. This supposedly couldn't be done in a 1,000 ft. or deeper pay.

Flowing the wells saved Stekoll an estimated 30 per cent in development and operating costs. Slim-holing saved

another estimated 25 per cent in equipment and completion costs.

He further reduced expenses by consolidating tank batteries and by cutting drilling time in half. He introduced the orifice method of controlling injection volumes of water at the input wells and dispensed with meters.

Takes nothing for granted . . . Stekoll has carried out the same sort of operation at Corsicana Shallow and Panhandle oil fields, where the majority of the rest of the company's 300 wells produce.

He takes no established engineering practice for granted no matter "how long it has been done or who does it."

Slim-holing has been a distinct characteristic of nearly all Stekoll operations.

The company has developed much of its own slim-hole completion and workover equipment. Stekoll argues that you can pump as much oil with the 1-in. "hollow rod" tubing and 2½-in. "casing" as with conventional tubing and rods. Plastic coating inside the 1-in. virtually eliminates any paraffin trouble.

A Big Brother . . . Obviously, the oil business is Stekoll's hobby as well as his job. But he has others.

He likes golf and swimming and dabbles in photography.

One of his most avid interests is his work in the Big Brothers organization —a group dedicated to filling voids in the lives of small boys with inadequate home lives due to death of the father, separated parents, or other reasons. Stekoll has been in this work since 1939 and is now president of the Dallas Big Brothers Foundation.

He talks easily, has a sharp wit, and seldom ruffles. Proof of this last trait came a couple of weeks ago. He took it in stride when summoned for jury duty just when he was in the midst of closing what he feels is the biggest deal of his career so far. This was the formation of a new firm, Stekoll Properties, within which certain financiers will back him to the tune of $20,000,000 or more in production-buying ventures.

E. J. Hyde has been named assistant manager of Standard Oil Co. of California's pipeline department. He succeeds **J. S. Grepe, Jr.,** retiring June 1 after 43 years with the company. Hyde has been general superintendent of the department's central district since 1955. **C. L. Reasoner** succeeds Hyde.

C. E. Davis, retired vice president of Shell Oil Co., **Allen J. Ely,** Esso Research & Engineering Co., **Harry Levin,** of The Texas Co., Beacon N. Y., and **J. B. Rather, Sr.,** formerly with Socony Mobil Oil Co., Inc., now retired, were honored by the American Petroleum Institute's Division of Refining at the recent midyear meeting in Montreal. The four were bestowed Certificates of Appreciation denoting "long or particularly outstanding service" to A.P.I. and to the industry.

K. L. Hayden has been named to manage a new crude purchasing department for Ashland Oil & Refining Co. in Evansville, Ind. **Charles H. Dougan** and **C. E. Corn** will be purchasers.

William K. Warren, board chairman and chief executive officer of Warren Petroleum Corp., Tulsa, has been elected a director of Gulf Oil Corp. His election is, in effect, a return to Gulf after nearly 35 years' absence. In 1916, Warren joined Gypsy Oil Co., then a Gulf subsidiary. He left Gypsy to found Warren Petroleum, which this year was merged into Gulf in a stock-transfer deal. In the interval, Warren built his firm to a dominant position in the natural gasoline and L.P.G. industries. The company continues under Warren management.

Personals

E. H. Tollefson, president of Hope Natural Gas Co. since 1953, has been elected executive vice president of the parent Consolidated Natural Gas Co., New York. Tollefson has been with the Consolidated system since 1930. Hope is principal producer of natural gas for the Consolidated system.

W. L. Kitsman has been promoted by Phillips Petroleum Co. from assistant western division superintendent, Midland, Tex., to Canadian district superintendent, Calgary. He replaces **W. S. Derrick,** recently transferred to Phillips' Bartlesville, Okla., headquarters. **Earl Sturm,** who has been district foreman in Calgary, moves to Cut Bank, Mont., as district production superintendent.

Owen C. Brown, Jr., geologist, and **Buel Humphries,** landman, will head a new district office being opened in New Orleans by Argo Oil Corp., Denver. It will be Argo's first district office, and will handle "future activities" for all South Louisiana. The firm now has no acreage in that area. Argo operates division offices in Denver, San Antonio, and Midland, Tex. Brown and Humphries earlier were with Seaboard Oil Co. in New Orleans.

Earl Kipp, The California Co.'s chief engineer the past 10 years, has been elected a director, vice president, and assistant to the president. He'll continue in the firm's New Orleans headquarters. Kipp joined The California Co. in 1936 as an engineer. After 4 years with affiliates, he moved to the parent firm as petroleum engineer, and served throughout its operating territory until taking the New Orleans post.

A. E. Dietert, former southwestern division geologist for Cities Service Oil Co., has been promoted to assistant to the chief geologist in Bartlesville. He'll head the company's joint-interest exploration and development program in the United States and Canada. **L. E. Patterson,** and **Paul Hyatt** will replace Dietert in the southwestern division. **P. E. Bernhart** transfers from Jackson, Miss., to succeed Patterson as West Texas district geologist. **R. M. Strom** moves from assistant West Texas district geologist to replace Hyatt as Oklahoma district exploration geologist.

P.E.P.A. Elects New Officers at Annual Convention

Fred Woerner, center, Texas Electric Service Co., Fort Worth, was recently elected president of the Petroleum Electric Power Association at the organization's twenty-eighth annual convention in Corpus Christi. Other new officers are J. F. Maddox, left, New Mexico Electric Service Co., Hobbs, N. M., vice president, and Harvey Cherry, right, Houston Lighting & Power Co., secretary and treasurer.

W. A. Pope has resigned as geologist with Union Oil Co. to join Lyons & McCord in Houston.

Charles W. Matthews has resigned as engineer with Universal Oil Products Co., Des Plaines, Ill., to join American Gilsonite Co. as operating foreman in Grand Junction, Colo.

Allen R. Kittleson has been named senior research associate of Esso Research & Engineering Co.

Norman Hardy has been promoted from vice president to executive vice president of Arabian American Oil Co. He'll continue to be headquartered in Dhahran, Saudi Arabia. Before he joined Aramco in 1951, Hardy was president of Richmond Petroleum Corp. (Standard Oil Co. of California subsidiary). He joined Socal in 1926 as a geologist, and later served in Indonesia, the Netherlands, and South America, as well as in the United States.

W. B. Strobel, director of Continental Oil Co.'s petrochemical projects development, has been chosen to receive the 1956-57 Sloan Fellowship from Massachusetts Institute of Technology.

Claude E. Peavy, who resigned recently as Rocky Mountain district superintendent for Phillips Petroleum Co., Denver, has joined Britalta Petroleums, Ltd., as vice president and manager in Calgary.

H. F. Crain has been transferred by Phillips Petroleum Co. from regional staff geologist in Bartlesville, Okla., to division development geologist in Lafayette, La.

D. L. Connelly, production division vice president and a director of Warren Petroleum Corp. since 1952, has been elected senior vice president of production and executive staff member. Other new executive staffers: **G. L. Brennan,** a vice president since 1954, becomes senior vice president, L.P.G. division; **C. E. Wharton,** named assistant production vice president in 1954, to be manufacturing vice president; **Rex V. Phelps,** manager of Warren's terminal and transportation division about a year, promoted to vice president of that division; **Fred S. Schwend,** assistant vice president of the L.P.G. division, advanced to vice president; **H. E. Beardmore,** assistant to Connelly since 1947, elected vice president, oil production; **S. I. Hulse,** named senior vice president, natural gasoline sales; and **W. B. Padon,** advanced from head of special product sales to projects-planning vice president. All changes are effective June 1.

Personals

Paul Courtney, who resigned recently as president and director of George Failing Corp., Enid, Okla., has been named general manager of Cardwell Manufacturing Co., Wichita. Before joining Failing, a Westinghouse Air Brake Corp. subsidiary, Courtney was president of Unit Rig & Equipment Co., Tulsa. Cardwell, a manufacturer and servicer of oil-well equipment, is owned by John W. Mecom, Houston independent.

Thomas F. Ritter has been transferred by Sun Oil Co. from its Tri-State office in Evansville, Ind., to Cuba to establish a Caribbean office.

R. E. McDonald has resigned as district geologist for El Paso Natural Gas Co. in Rock Springs, Wyo., to become a consultant there.

Arthur L. Quackenboss, former head of crude purchases for Union Oil Co., has been elected president of Ajax Petroleum Corp., newly formed to operate properties in the Mid-Continent and Pacific Coast areas. Other officers: **P. F. Mock,** Ajax Oil & Development Co., Encino, Calif., and **C. H. Anderson,** Brush, Colo., vice presidents; and **Edward R. Downing,** New York, vice president. The new firm will be headquartered in Encino, and open an engineering and operations office in Brush.

W. O. Hoffman has been named superintendent of Atlantic Refining Co.'s Philadelphia refinery. He succeeds **J. P. McCulley,** retiring in August after 47 years with Atlantic. Other management changes at the Philadelphia plant: **J. W. Braun,** from assistant to the manufacturing vice president to chemicals department superintendent; **A. A. Muse,** to technical assistant to the manufacturing vice president; **W. E. Chalfant,** to assistant manager of product control; **K. G. Krech,** to assist the general manager of crude purchases and sales; and **A. J. Ferkel,** to assistant chemicals department superintendent.

Robert L. Smith has been advanced by Shell Oil Co. from production geologist in Houston to division production geologist in Hobbs, N. M.

Harry A. Brown has resigned as manufacturing vice president of Frontier Refining Co., Cheyenne, Wyo., to join D-X Sunray Oil Co., Tulsa, as refining vice president, effective July 2.

Tom Trax, with Gulf Oil Corp. in Ardmore, Okla., has been elected president of the American Petroleum Institute's Arbuckle chapter. He succeeds **Jack Marshall,** Continental Oil Co. Elected vice presidents: **Jack Denny,** Phillips Petroleum Co.; **Monroe Sanders,** Parkersburg Rig & Reel Co.; **Marvin Whited,** National Tank Co., and **Doc Ramabo,** of Magcobar Products. New secretary-treasurer is **Bob Basche,** of Schlumberger Well Surveying Corp.

DEATHS

Milton Earl Hazlett, 69, retired pioneer driller, died recently in Gary, Ind. Hazlett spent 12 years in Burma and India. He also had been active in Alaska, the Bakersfield, Calif., area, Oklahoma, and Texas.

Edward F. Greer, 45, Houston, a Gulf Oil Corp. scout, died recently in Houston.

W. E. King, 60, owner of King Oil Tool Co., Houston, died there May 20.

Herbert Bird Wheeler, 88, retired Union Oil Co. executive, died recently in Santa Barbara, Calif. Wheeler managed Union's Hawaiian operations before retiring.

James A. Burhans, 49, Bismarck, N. D., manager of Calvert Exploration Co., died May 21 in Bismarck. Before joining Calvert, Burhans was an Evansville, Ind., independent operator.

Rodney Vincent Reagor, assistant manager of Stanolind Oil & Gas Co.'s Levelland, Tex., gas plant since 1950, died May 19 in Levelland. He was 36.

John M. Metheany, Sr., 71, veteran Michigan independent landman, died May 14 in Edmore, Mich.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Billings, Montana. Notice is hereby given that six parcels of land totaling 819.27 acres within the known geologic structure of Kevin-Sunburst Field in Toole County, Montana, and 56 parcels of land totaling 24,486.66 acres within the known geologic structure of Bowdoin Field in Phillips and Valley Counties, Montana, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 9:00 a. m., M.S.T., July 17, 1956, when bids will be opened. The following are the lands offered for sale: KEVIN-SUNBURST Field, T. 34 N., R. 3 W., P. M., Montana. Parcel 1: Sec. 1; Lots 3, 4, SW^{1}_{4} NW^{1}_{4} containing 119.97 acres; Parcel 2: Sec. 2; Lots 1, 2, S^{1}_{2} NE^{1}_{4} containing 159.90 acres. T. 35 N., R. 2 W., P. M., Montana. Parcel 3: Sec. 7; SE^{1}_{4} SE^{1}_{4} containing 40.00 acres; Parcel 4: Sec. 8; E^{1}_{2} NW^{1}_{4}, NE^{1}_{4} SW^{1}_{4}, E^{1}_{2} NW^{1}_{4} SE^{1}_{4} containing 140.00 acres; Parcel 5: Sec. 33; N^{1}_{2} S^{1}_{2}, SW^{1}_{4} SW^{1}_{4} containing 200.00 acres. T. 35 N., R. 3 W., P. M., Montana. Parcel 6: Sec. 35; SE^{1}_{4} containing 160.00 acres. BOWDOIN FIELD. T. 30 N., R. 34 E., P. M., Montana. Parcel 7: Sec. 2; Lots 1, 2, 3, 4, 7, 8, 9, 10 containing 260.32 acres; Parcel 8: Sec. 3; Lots 1, 2 containing 47.73 acres; Parcel 9: Sec. 3; Lot 12 Sec. 4; Lot 9 containing 85.17 acres; Parcel 10: Sec. 4; Lots 4, 5, 12 containing 104.25 acres; Parcel 11: Sec. 5; Lots 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 containing 420.08 acres. T. 31 N., R. 33 E., P. M., Montana. Parcel 12: Sec. 2; SW^{1}_{4} containing 160.00 acres; Parcel 13: Sec. 3; S^{1}_{2} containing 320.00 acres; Parcel 14: Sec. 8; S^{1}_{2} containing 320.00 acres; Parcel 15: Sec. 9; all containing 640.00 acres; Parcel 16: Sec. 10; all containing 640.00 acres; Parcel 17: Sec. 11; NW^{1}_{4}, S^{1}_{2} containing 480.00 acres; Parcel 18: Sec. 14; all containing 640.00 acres; Parcel 19: Sec. 15; all containing 640.00 acres; Parcel 20: Sec. 17; all containing 640.00 acres; Parcel 21: Sec. 18; Lots 1, 2, 3, 4, E^{1}_{2}, E^{1}_{2} W^{1}_{2} containing 629.14 acres; Parcel 22: Sec. 19; Lots 1, 2, 3, 4, E^{1}_{2}, E^{1}_{2} W^{1}_{2} containing 630.94 acres; Parcel 23: Sec. 22; NW^{1}_{4} containing 160.00 acres; Parcel 24: Sec. 24; SW^{1}_{4} containing 160.00 acres; Parcel 25: Sec. 25; all containing 640.00 acres; Parcel 26: Sec. 26, E^{1}_{2}, NW^{1}_{4} containing 480.00 acres; Parcel 27: Sec. 27; NE^{1}_{4} containing 160.00 acres. T. 31 N., R. 34 E., P. M., Montana. Parcel 28: Sec. 31; Lots 1, 2, 3, 4, E^{1}_{2}, E^{1}_{2} W^{1}_{2} containing 640.08 acres; Parcel 29: Sec. 32; all containing 640.00 acres; Parcel 30: Sec. 33; S^{1}_{2} containing 320.00 acres; Parcel 31: Sec. 34; SE^{1}_{4} NE^{1}_{4}, NE^{1}_{4} SE^{1}_{4}, S^{1}_{2} SE^{1}_{4}, SW^{1}_{4} containing 320.00 acres; Parcel 32: Sec. 35; E^{1}_{2}, SE^{1}_{4} NW^{1}_{4}, E^{1}_{2} SW^{1}_{4} containing 440.00 acres. T. 32 N., R. 31 E., P. M., Montana. Parcel 33: Sec. 2; Lots 3, 4, S^{1}_{2} N^{1}_{2}, SW^{1}_{4} containing 401.14 acres; Parcel 34: Sec. 3; Lots 1, 2, 3, S^{1}_{2} N^{1}_{2}, S^{1}_{2} containing 601.79 acres; Parcel 35: Sec. 3; Lot 4 Sec. 4; Lots 1, 2, S^{1}_{2} NE^{1}_{4}, SE^{1}_{4} containing 361.95 acres; Parcel 36: Sec. 9; E^{1}_{2} containing 320.00 acres; Parcel 37: Sec. 10; all containing 640.00 acres; Parcel 38: Sec. 11; N^{1}_{2}, N^{1}_{2} S^{1}_{2}, S^{1}_{2} SE^{1}_{4}, SE^{1}_{4} SW^{1}_{4} containing 600.00 acres; Parcel 39: Sec. 14; E^{1}_{2}, E^{1}_{2} W^{1}_{2} containing 480 acres; Parcel 40: Sec. 15; NW^{1}_{4}, NW^{1}_{4} SW^{1}_{4}, S^{1}_{2} SW^{1}_{4} containing 280.00 acres; Parcel 41: Sec. 21; E^{1}_{2} containing 320.00 acres; Parcel 42: Sec. 22; NW^{1}_{4} NE^{1}_{4}, N^{1}_{2} NW^{1}_{4}, S^{1}_{2} N^{1}_{2}, S^{1}_{2} containing 600.00 acres; Parcel 43: Sec. 23; N^{1}_{2} NE^{1}_{4}, NE^{1}_{4} NW^{1}_{4}, S^{1}_{2} N^{1}_{2}, S^{1}_{2} containing 600.00 acres; Parcel 44: Sec. 25; W^{1}_{2} containine 320.00 acres; Parcel 45: Sec. 26; all containing 640.00 acres; Parcel 46: Sec. 27; all containing 640.00 acres; Parcel 47: Sec. 35; N^{1}_{2} SE^{1}_{4} containing 480.00 acres; Parcel 48: Sec. 36; all containing 640.00 acres. T. 33 N., R. 31 E., P. M., Montana. Parcel 49: Sec. 13; W^{1}_{2} containing 320.00 acres; Parcel 50: Sec. 14; Lot 1, E^{1}_{2} E^{1}_{2}, NW^{1}_{4} NE^{1}_{4}, NE^{1}_{4} NW^{1}_{4}, W^{1}_{2} NW^{1}_{4}, NW^{1}_{4} SW^{1}_{4} containing 399.32 acres; Parcel 51: Sec. 15; N^{1}_{2}, N^{1}_{2} S^{1}_{2}, S^{1}_{2} SW^{1}_{4} containing 560.00 acres; Parcel 52: Sec. 21; NW^{1}_{4} NW^{1}_{4}, S^{1}_{2} NW^{1}_{4}, SW^{1}_{4}, W^{1}_{2} SE^{1}_{4} containing 360.00 acres; Parcel 53: Sec. 22; Lots 4, 10, 11, 13, N^{1}_{2} NW^{1}_{4}, SW^{1}_{4} NW^{1}_{4}, SE^{1}_{4}; Sec. 23; SW^{1}_{4} SW^{1}_{4}; Sec. 27; Lot 2 containing 394.84 acres; Parcel 54: Sec. 23; Lots 1, 3, 5, 7, 8, NE^{1}_{4} NE^{1}_{4}; Sec. 22; Lot 8, Sec. 24; N^{1}_{2} NW^{1}_{4} containing 256.93 acres; Parcel 55: Sec. 26, Lot 1, SE^{1}_{4} NE^{1}_{4}, W^{1}_{2} NE^{1}_{4}, W^{1}_{2} containing 478.24 acres; Parcel 56: Sec. 27; E^{1}_{2}, SE^{1}_{4} NW^{1}_{4}, E^{1}_{2} SW^{1}_{4}, SW^{1}_{4} SW^{1}_{4}; Sec. 28; SE^{1}_{4} SE^{1}_{4} containing 320.00 acres; Parcel 57: Sec. 28, Lots 2, 4, 5, 6, 9; Sec. 29; Lots 2, 6, 7, 8, 10 containing 294.74 acres; Parcel 58: Sec. 28; NW^{1}_{4} NE^{1}_{4}, N^{1}_{2} NW^{1}_{4}; Sec. 29; N^{1}_{2} N^{1}_{2}, SW^{1}_{4} NE^{1}_{4}, S^{1}_{2} NW^{1}_{4} containing 400.00 acres; Parcel 59: Sec. 32, all containing 640.00 acres; Parcel 60: Sec. 33; all containing 640.00 acres; Parcel 61: Sec. 34; N^{1}_{2}, N^{1}_{2} S^{1}_{2}, SW^{1}_{4} SW^{1}_{4} containing 520.00 acres; Parcel 62: Sec. 35; NW^{1}_{4} containing 160.00 acres.

The following described land located in Parcels 44, 45, 46, 47, and 48 are subject to the provisions of stipulations identified as 3g and 12. T. 32 N., R. 31 E., P. M., Montana. Sec. 25; S^{1}_{2} SW^{1}_{4}; Sec. 26; SW^{1}_{4} NE^{1}_{4}, S^{1}_{2} NW^{1}_{4}, SE^{1}_{4}, E^{1}_{2} SW^{1}_{4}, NW^{1}_{4} SW^{1}_{4}; Sec. 27; S^{1}_{2} NE^{1}_{4}, SE^{1}_{4} NW^{1}_{4}, N^{1}_{2} SE^{1}_{4}, SW^{1}_{4} SE^{1}_{4}, SW^{1}_{4}; Sec. 35; NE^{1}_{4}; Sec. 36; all. Separate bids must be submitted on each parcel. The successful bidder (s) will reimburse the Bureau of Land Management for their proportionate share of the local publication cost of this sale. Details of the lease offering, special stipulations, and how and where to submit bids may be obtained from the Manager, Land Office, 1245 North 29th Street, Billings, Montana. Orval G. Hadley, Manager, Land Office.

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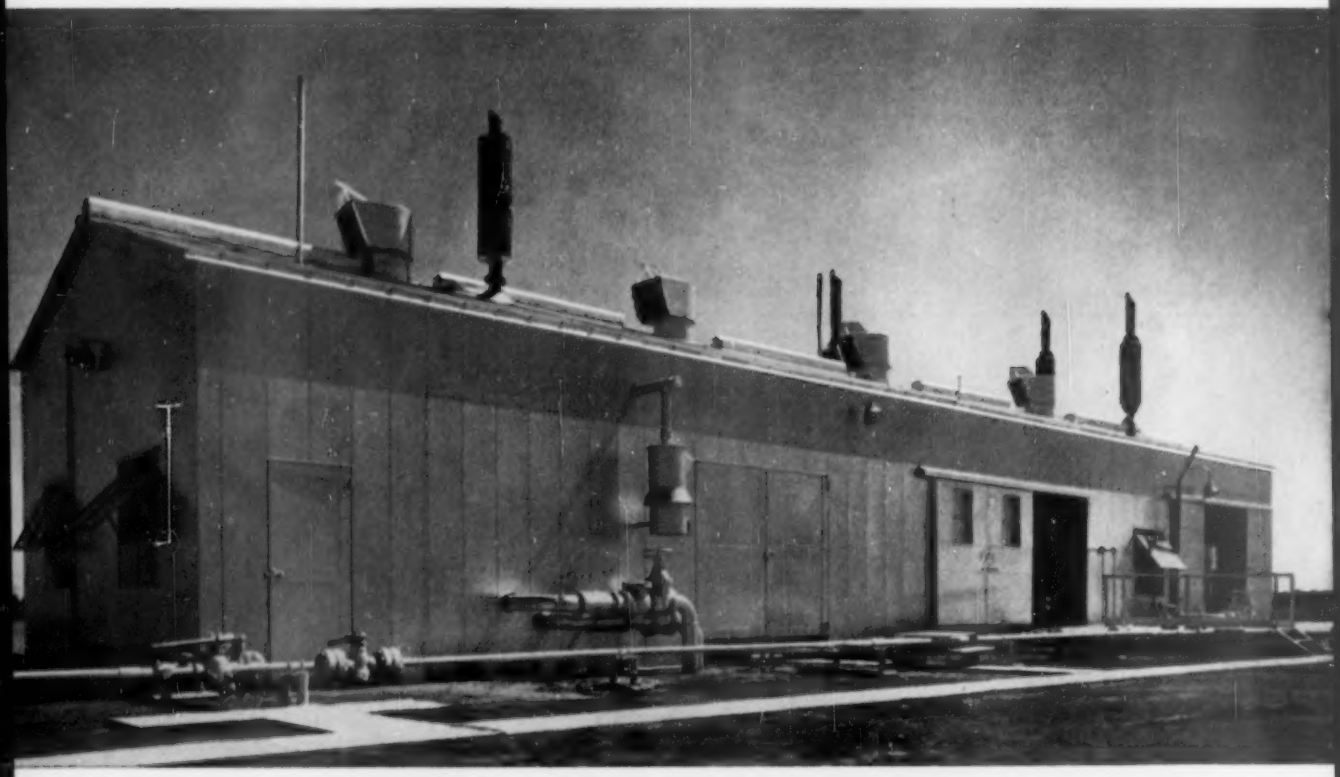

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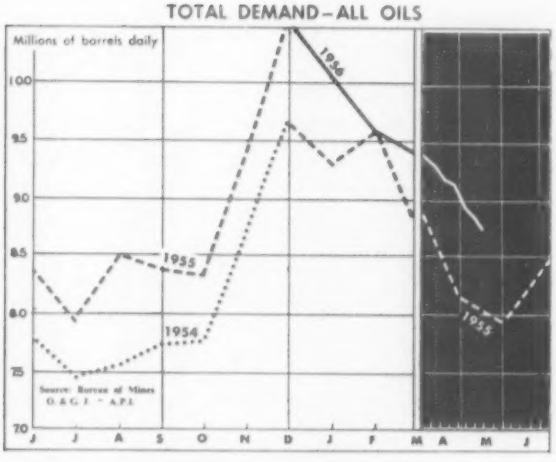
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,053,690	UP	22,800	UP	393,710
Crude stocks	273,606,000	DOWN	1,814,000	DOWN	4,602,000
Completions	1,237	UP	115	DOWN	43
Refinery runs	7,848,000	DOWN	63,000	UP	519,000
Gasoline stocks	186,753,000	DOWN	955,000	UP	16,076,000
Kerosine stocks	19,931,000	UP	599,000	DOWN	4,213,000
Distillate stocks	68,495,000	UP	3,550,000	DOWN	7,614,000
Residual stocks	33,414,000	UP	295,000	DOWN	9,972,000
Four-product stocks	308,593,000	UP	3,489,000	DOWN	5,723,000
Total imports	1,350,100	DOWN	78,800	UP	302,300

TOTAL DEMAND—ALL OILS



Gasoline Markets Are Firm, But a Few Weak Spots Could Be Indicators

GASOLINE markets are generally firm but with several reported cases of local weakness. Premium gasoline on the Gulf Coast still is very tight. Also, better grades of regular are firm.

Only a few instances of discounting have been reported for the North Central area following the boost in prices to cover increases in octane quality. Normal spot quotations to jobbers for regular gasoline rated at 88 octane is 11.75 cents per gallon Group 3. Some interrefinery exchanges are made on a basis of 11.50 cents Group 3, but this is normal practice for the area. Also, sales through brokers or resellers net the refiner 11.50 cents. Again, this is normal for the marketing area.

There have been a few unconfirmed reports of sales direct to private-brand distributors at prices generally quoted for brokers or for interrefinery sales. Some marketers report that these sales represent such a small portion of the over-all gasoline business for the area that they will not influence the general market. Other suppliers, selling part of their output on the spot market, say that they cannot afford to lose early-season customers to refiners quoting discounts of 0.25 cent.

There were two other small indicators of disturbance in the Group 3 gasoline market. Retail gasoline price wars started at Kansas City and Tulsa during the week. However, price wars in these areas tend to clear up in a short time.

On the East Coast, Sinclair Refining Co. joined the list of companies with established retail gasoline prices in New Jersey under the fair-trade laws of that state. In addition to Sinclair the following have posted retail prices: Esso Standard Oil Co., Cities Service Oil Co., Socony Mobil Oil Co., The California Co., and The Texas Co.

Voluntary allowances to gasoline dealers again moved in to the New England area, following an attempt earlier in the month to end the series of retail price wars that has plagued the area for many months. Allowances in Boston were reported to range from 1.5 to 3.0 cents a gallon. Allowances to dealers in Providence average about 2.5 cents.

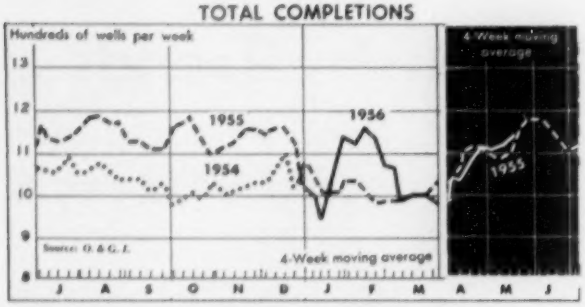
Summer-fill programs on the East Coast are falling into three general groups: (1) Price protection for resellers with deferred billing for reseller or consumer with established credit; (2) price protection to consumers but no deferred billing; and (3) price protection and deferred billing for both reseller and consumer.

None of the announced plans calls for a summer discount, but one independent supplier in the New York Harbor area is reported to be granting a discount of 0.5 cent a gallon on transport truck sales of No. 2 fuel and kerosine. Since there is no oversupply of light fuels in the area, the discount certainly does not indicate a soft market.

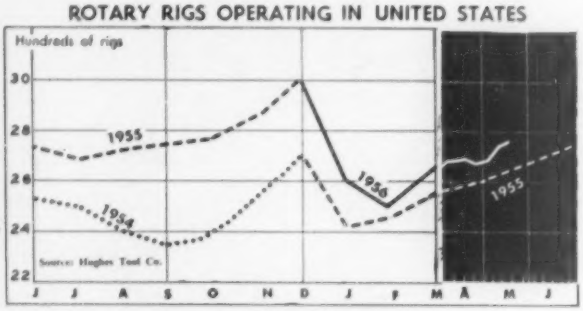
On May 18, East Coast stocks of kerosine were down 2,700,000 bbl. from last year and distillate stocks were off 5,800,000 bbl. More of the Gulf-East Coast movement of light fuels this summer will be needed to rebuild primary stocks on the East Coast than last year.

The required movement of about 8,500,000 bbl. more this summer than a year ago will call for more spot tanker charters which will tend to prevent an early seasonal drop in the tanker market.

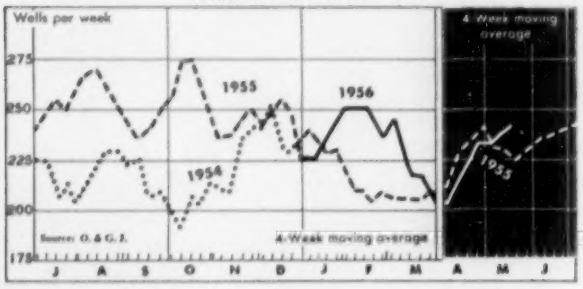
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	5-21-56	5-14-56	5-23-55
North Central and East	140	121	164
Southeast	28	34	37
Okla., Kans., Ark., Mo.	503	521	499
Louisiana	439	435	392
N. and E. Texas-Panhandle	447	455	398
Gulf and South Texas	270	264	235
West Texas-New Mexico	557	565	534
Rocky Mountain	256	242	243
Pacific Coast	128	127	151
Total United States	2,768	2,764	2,653
Western Canada	198	176	129

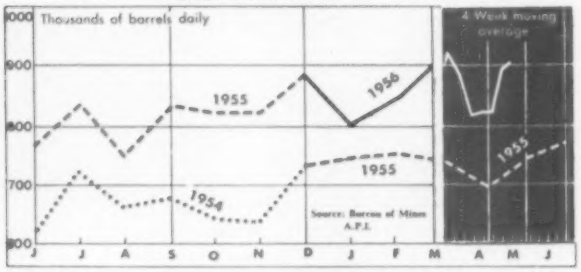
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 19, 1956

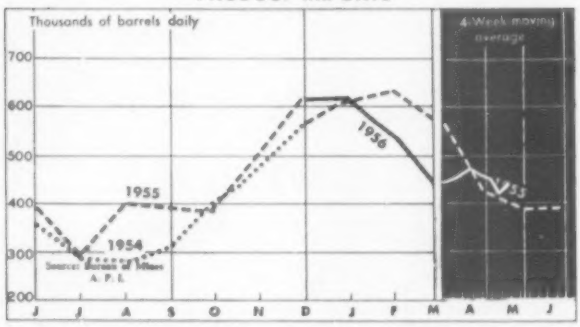
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	0	0	2	6,025	39	38	0	0	0	2	2	0	0	1	20	21
Arkansas	13	6	1	6	44,506	298	266	1	0	0	3	4	14	0	2	47	63
California	55	39	1	15	241,707	820	1,013	0	0	0	9	9	15	0	2	158	175
Colorado	27	6	4	17	142,376	442	518	0	0	0	10	10	9	0	6	192	207
Illinois	97	44	0	53	233,600	1,347	1,380	3	0	0	10	13	24	0	0	233	247
Indiana	14	7	0	7	21,552	231	273	2	0	0	1	3	8	0	1	41	50
Kansas	97	39	7	*51	334,771	1,927	1,961	2	0	0	25	27	46	1	10	335	392
Kentucky	33	9	2	22	54,162	637	475	3	0	1	6	10	15	0	1	142	158
Louisiana	91	48	12	31	631,369	1,461	1,464	3	0	6	16	25	42	28	24	195	289
North	40	31	1	8	117,382	563	761	0	0	0	5	5	10	1	1	70	82
South	40	10	11	19	419,057	715	703	3	0	6	8	17	27	24	14	110	175
Offshore	11	7	0	4	94,930	183		0	0	0	3	3	5	3	9	15	32
Michigan	5	3	0	2	13,120	171	192	1	0	0	2	3	4	0	0	55	59
Mississippi	6	2	0	4	39,025	171	188	0	0	0	2	2	6	0	1	64	71
Montana	6	3	0	3	43,327	122	123	0	0	0	3	3	5	0	0	30	35
Nebraska	20	8	0	12	114,619	361	260	1	0	0	7	8	15	0	0	168	183
New Mexico	26	17	6	3	115,173	673	549	1	0	0	3	4	20	0	5	59	84
Northwest	7	0	5	2	28,171	228	152	0	0	0	2	2	2	0	5	16	23
Southeast	19	17	1	1	87,002	445	397	1	0	0	1	2	18	0	0	43	61
North Dakota	2	1	0	1	10,857	87	78	1	0	0	1	2	6	0	0	17	23
Ohio	7	5	0	2	20,084	391	408	0	0	0	1	1	0	0	1	4	5
Oklahoma	192	112	9	†71	668,701	3,373	3,351	0	1	0	20	21	48	13	13	282	356
Pennsylvania-New York	5	0	5	0	48,617	406	653	0	0	0	0	0	0	0	3	2	5
Texas	498	315	26	157	2,100,998	8,322	7,529	12	0	7	91	110	298	20	73	1,785	2,176
Southwest (1 & 4)	55	29	6	20	240,293	1,204	1,176	3	0	1	15	19	59	5	24	341	429
Gulf Coast (2 & 3)	55	25	9	21	349,418	1,045	986	0	0	4	15	19	26	8	30	271	335
East (5 & 6)	20	10	2	8	111,331	436	366	2	0	1	6	9	6	1	5	160	172
North Central (7-B & 9)	189	108	0	81	591,292	2,952	2,696	5	0	0	37	42	131	0	2	692	825
West (7-C & 8)	137	117	0	20	664,010	2,221	1,914	1	0	0	18	19	74	0	6	296	376
Panhandle (10)	42	26	9	7	144,654	464	391	1	0	1	0	2	2	6	6	25	39
Utah	4	1	0	3	14,111	36	27	0	0	0	2	2	1	0	1	21	23
West Virginia	18	2	13	3	16,263	254	230	0	0	0	1	1	0	0	2	5	7
Wyoming	17	12	0	5	80,511	284	300	0	0	0	2	2	6	0	4	74	84
Miscellaneous (Nev., Idaho)	2	0	0	2	12,413	56	15	0	0	0	2	2	4	0	0	43	47
Total United States	**1,237**	679	86	472	5,007,887	21,909	21,291	30	1	14	219	**264**	586	62	150	3,962	4,760
Total previous week	1,122	610	64	448	4,635,460			26	2	15	215	258	556	61	136	3,743	4,496
Total May 21, 1955	1,280	722	101	457	4,901,671			33	6	13	179	231	584	88	139	3,591	4,402
Cumulative 1956	21,909	12,113	1,408	8,388	89,702,979												
Western Canada	24	12	2	10	123,613	847											

Service wells included: *2, †9.

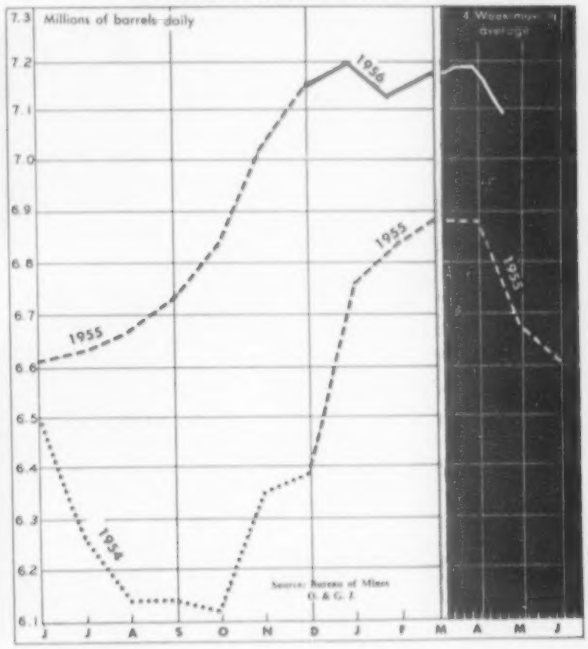
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

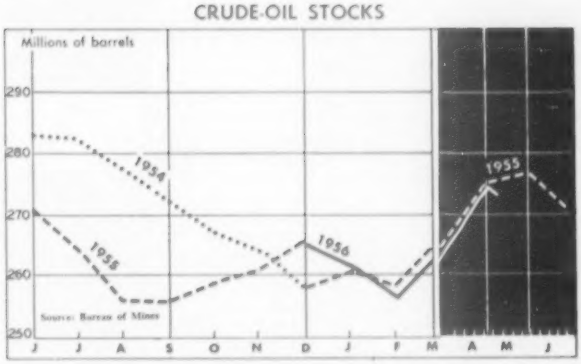


DAILY AVERAGE PRODUCTION FOR WEEK

	May 19 Crude oil	May 19 Lease condensate	May 19 Total	May 12 total
Alabama	5,000		5,000	4,900
Arkansas	72,100	500	72,600	72,800
California	965,400		965,400	964,800
Colorado	167,400		167,400	162,300
Eastern	49,000		49,000	49,200
Florida	1,375		1,375	1,375
Illinois	228,400		228,400	227,600
Indiana	30,700		30,700	32,000
Kansas	338,800		338,800	335,400
Kentucky	48,500		48,500	48,600
Louisiana	729,650	60,350	790,000	790,700
North	121,650	2,350	124,000	124,700
South	608,000	58,000	666,000	666,000
Michigan	29,800		29,800	28,800
Mississippi	107,000	3,700	110,700	110,700
Montana	53,700		53,700	51,900
Nebraska	37,200		37,200	40,800
New Mexico	241,500	3,200	244,700	244,500
North Dakota	27,800		27,800	27,300
Oklahoma	594,700		594,700	576,500
Texas	2,924,000	51,215	2,975,215	2,975,215
Dist. 1	54,800	425	55,225	55,225
Dist. 2	150,000	8,175	158,175	158,175
Dist. 3	425,700	25,000	450,700	450,700
Dist. 4	235,000	4,900	239,900	239,900
Dist. 5	45,000	450	45,450	45,450
Dist. 6	122,000	5,850	127,850	127,850
East Texas Field	209,500		209,500	209,500
Dist. 7-B	152,000	50	152,050	152,050
Dist. 7-C	185,000	4,005	189,005	189,005
Dist. 8	1,042,000	1,800	1,043,800	1,043,800
Dist. 9	209,000	400	209,400	209,400
Dist. 10	94,000	160	94,160	94,160
Utah	5,300		5,300	5,200
Wyoming	277,200		277,200	280,100
Others	‡200		‡200	200
Total U. S.	6,934,725	118,965	7,053,690	7,030,890
Change from previous week, up			22,800	
Canada	†416,400		†416,400	380,264
Total U. S. production January 1-May 19			995,703,205 bbl.	
Same period last year (crude plus cond.)			*948,105,360 bbl.	

*Includes 15,977,000 bbl. condensate. †Week ended previous Monday. ‡Nevada.

CRUDE-OIL STOCKS



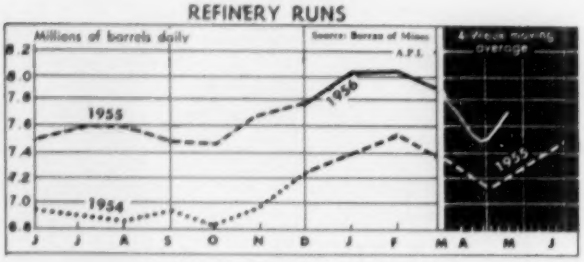
CRUDE-OIL STOCKS BY STATES OR ORIGIN*

(Thousands of barrels)

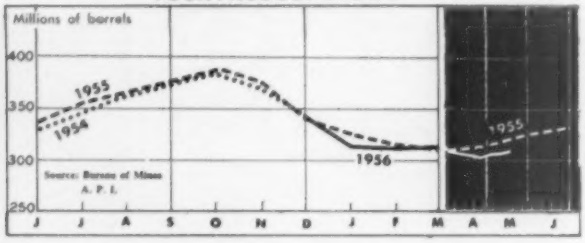
	5-12-56	5-5-56	5-14-55
Pennsylvania Grade	2,747	2,737	2,894
Other Appalachian	2,124	2,230	1,840
Illinois, Indiana, Michigan	10,012	9,637	12,141
Nebraska, North Dakota	2,320	2,313	2,325
Kansas	9,036	9,024	8,952
Oklahoma	26,734	25,349	24,614
Arkansas	3,058	3,181	2,791
Louisiana	16,784	17,457	16,462
North	2,646	2,627	2,650
South	14,138	14,830	13,812
Mississippi	2,956	3,124	3,019
New Mexico	7,507	7,828	9,013
Texas	125,814	127,269	128,735
East Texas proper	9,159	9,425	10,392
West Texas	62,101	62,809	56,449
Texas	22,906	22,630	25,951
Other Texas	31,648	32,405	35,943
Wyoming	16,857	17,587	15,735
Other Rocky Mountain	5,954	5,988	5,212
California	27,760	28,542	31,696
Foreign	†13,943	13,154	12,679
Total	273,606	275,420	278,208

*Bureau of Mines. †Includes 2,535,000 bbl. in California.

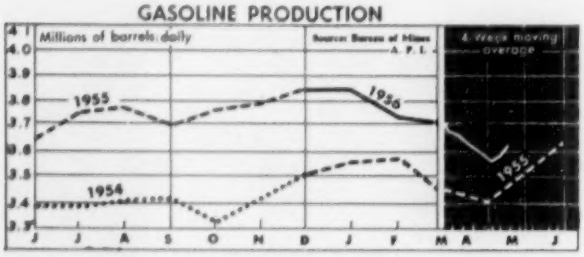
REFINERY RUNS



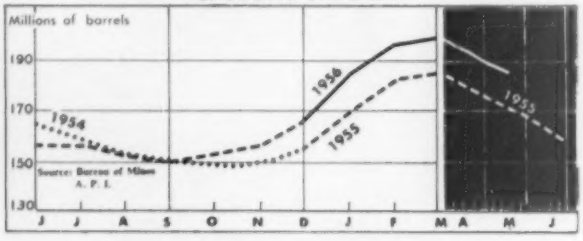
FOUR-PRODUCT STOCKS



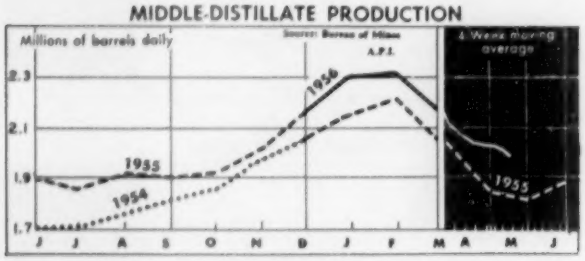
GASOLINE PRODUCTION



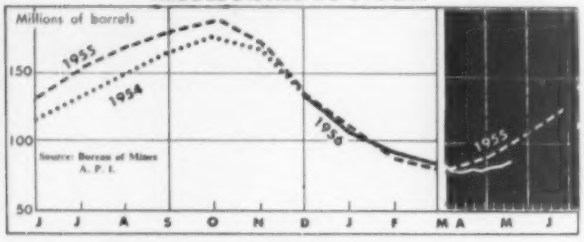
GASOLINE STOCKS



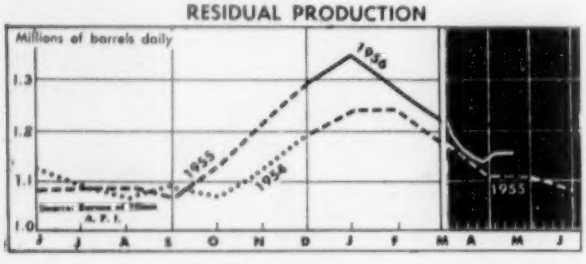
MIDDLE-DISTILLATE PRODUCTION



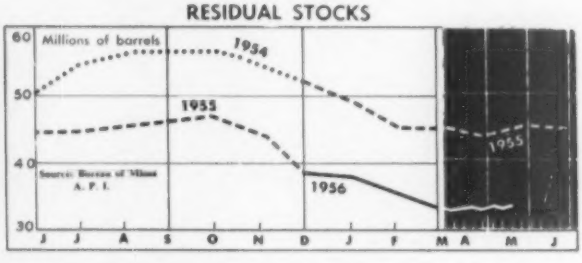
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MAY 18

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,027	396.0	25.4	260.9	209.9	40,434	7,422	19,348	8,018	1,003	390.2	31.0	233.2	179.5
Appalachian:														
District 1	84	28.0	3.1	18.1	6.9	4,667	370	1,236	276	82	34.3	2.1	18.0	3.5
District 2	109	51.1	3.1	17.7	12.6	2,965	541	642	206	98	52.6	3.0	13.7	11.2
Ind., Ill., Ky.	1,364	677.7	85.3	255.1	175.0	39,574	3,665	11,242	3,914	1,345	678.0	66.7	243.1	158.7
Okla., Kans., Mo.	752	396.4	19.0	181.4	26.3	19,524	992	7,408	1,087	642	352.0	16.1	150.8	33.5
Inland Texas	269	185.3	5.6	48.7	25.1	6,615	414	1,424	1,398	251	190.0	8.4	47.8	22.9
Texas Gulf Coast	2,007	925.7	96.3	473.6	266.4	25,567	3,027	9,538	4,777	1,804	851.9	104.1	405.0	254.4
La. Gulf Coast	702	361.3	40.9	166.0	49.0	10,034	2,394	5,137	1,531	626	328.0	49.1	171.5	49.5
N. La. and Ark.	93	28.4	3.6	22.7	6.9	4,402	424	1,118	47	95	33.5	7.1	23.7	5.1
Rocky Mountain:														
New Mexico	23	11.7		3.9	2.7	349	6	100	19	21	10.0	0.3	3.6	2.8
Other Rocky Mtn.	266	117.2	4.9	67.6	32.7	7,611	279	2,199	766	235	106.5	2.0	57.8	35.1
California	1,152	471.2	6.4	145.7	360.8	25,011	397	9,103	11,375	1,066	480.9	5.7	151.0	354.3
May 18, 1956	7,848	3,650.0	293.6	1,661.4	1,174.3	186,753	19,931	68,495	33,414	7,268	3,507.9	295.6	1,519.2	1,110.5
May 11, 1956	7,911	3,771.9	323.3	1,637.4	1,177.7	187,708	19,332	64,945	33,119					
May 20, 1955	7,329	3,507.4	309.3	1,508.1	1,154.9	170,677	24,144	76,109	43,386					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.75-12.00
Premium (96 octane)	13.50-13.75
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.25-11.50
Regular (92 octane)	11.50-12.00
Premium (97 octane)	13.00-13.25
Premium (98 octane)	13.25-13.75
California—Los Angeles (rack):	
Regular (84 octane)	12.9-13.40
Premium (93 octane)	14.0-14.25
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.25
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	8.75-9.25
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

• Denotes change from previous week

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.10-2.20

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
★ 145-155 vis. at 210, bright stock, 8 color, 25 p.t.	25-26
★ 200 vis. neutral (180 at 100°), 25 p.t.	21.5

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16.16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$2.91	2.45	
25-25.9	2.64	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.50
34-34.9	3.27	2.78	3.11	2.65	2.52
35-35.9	3.34	2.80	3.13	2.67	2.54
36-36.9	3.39	2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, May 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.45
Middle District	4.32
Southwest Pennsylvania	4.03
West Virginia	3.91
★ Buckeye Grade	3.85
★ Zanesville Grade	3.10
Illinois Basin	3.00
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.80
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-48.9°, Tucupido	•3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	•3.04
Oficina, 35°-35.9°, Puerto La Cruz	•2.80
Tia Juana medium, 26.5°-26.9°, Amuay	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

•Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0-34.9°, Abadan	1.86
Iraq, 36.0-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

(Latest reported spot fixture)

★NWI-U.S.N.H., dirty (USMC+50%)	$4.05
★P.G.-U.K., dirty (Scale+105%) (110s. 10d.)	15.13
★P.G.-U.S.N.H., dirty (USMC+40%)	17.78
★P.G.-Japan, dirty (USMC+55%)	13.95
★Sidon-U.S.N.H., dirty (USMC+35%)	10.53

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FAILING 1500 H.D. drill with 4½ x 5 pump, automatic pulldown, mounted on 1951 Ford. Also, Griffin water tank, mounted on 1951 Ford. Write P. O. Box 819, Longmont, Colo., Phone 1333.

GARDNER-DENVER 2-stage gas compressor, less engine, completely unitized with coolers, scrubbers and engine skid. Completely overhauled by Gardner-Denver. Perfect condition guaranteed. Gulf Southwest Service Co., P. O. Box 1328, Shreveport, La.

FOR SALE

Complete Wilson Super Titan Rotary Drilling Rig with 136 foot standard derrick, powered by 4 Cummings L1-600 motors just converted to gas-butane (all equipment for reconversion to diesel to be included), one 8" x 20" Gardner-Denver mud pump, one 7¼" x 18" Wilson Snyder mud pump, 3 steel mud pits and all accessories. Subject to inspection on currently drilling 12,500' hole in West Texas. Priced for ready sale upon completion present well contract.

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U-15 DRILLING RIG located in Beaver County, 3 NKU Waukesha Motors, Hydraulic Floor Operated Blowout Preventor, 131' Lee C. Moore Mast, steel mud pits, 7¾ x 16 Gardner-Denver pump, 8000' 4½" Drill Pipe recomplete. Call CEntral 2-6318, Oklahoma City, Oklahoma.

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UOP RATED 144 BBL./DAY

Complete Perco unit built 1950, Phillips Petroleum rated 1400 bbl./day.
1—Wyatt 30" x 70' Stabilizer 160# 30 tray
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
5—Adm. Heat Exchangers, 644, 424, 346, 176 sq. ft.
2—Perco reactors 4500 gal., 8' x 12', 347 stls. st. 120#, 1000° F.
1—5' x 96' tower, 40 tray, 135# WP.
1—7' x 30' Propane tank, 250# WP.
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
5—Welded tanks, 10' x 40', 10' x 30', 5' x 20'.
9—Oilfield boilers, 125 hp., 275#.
1—Ethyl lead plant.
3—Penn. comp. 8 x 11 x 9, 12 x 11½ x 13, 10 x 6 x 11.
2—Convection furnaces, 20 MIL BTU/hr.
1—Vapor phase cracking furnace.
12—Welded storage tanks, 5000, 2000, 1,000, bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
30—Duplex piston pumps, all sizes.
1—10' x 30' asphalt still.
6—Steel Bldgs., 20 x 150, 20 x 20, 20 x 40.
1—BS&B Oil and gas separator, 10.7 mcf, 3500 BBl./day.
Large Selection of Series 15, 30 Steel Valves, 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

TOWERS & VESSELS

8' x 75' 25 tray 40#
2' x 60' 35 tray 560#
5'6" x 59' 30 tray 200#
2' x 42' 30 tray 250#
13" x 35' 30 tray 500#
2—8½' x 23' hor tanks 50# WP.

COMPRESSORS

2 Worth LTC-6 800 hp.
1 Worth LTC-3 400 hp.
1 IR XVG-8 300 hp.
3 Penn Comps 430 CFM 500 lbs., 276 CFM 160 lbs., 230 CFM 150 lbs.

MISCELLANEOUS

6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—Atmospheric Bentube exch., stls and Adm. 715, 470 sq. ft.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
800 ft. of 2" 4-6 ch pipe.
Large quantity of 410 SS chrome strips and sheets.
Tremendous selection stainless steel and steel valves ½"-6".
BJ hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.
Gould 16" pump 10,500 gpm, 135' hd.

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BRILL EQUIPMENT COMPANY

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FOR SALE EQUIPMENT

60-L BYCYRUS 1956 Model three-months old, complete with tools, from 10" to 4". $15,000.00. Endicott Supply, Sedan, Kansas, Ph. 554.

LINER FOR 5½" 2500' 4" od, 9.20 lb., 11½ thread. Number one. 85c. M. J. Regan Pipe Co., Coffeyville, Kans.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

GASOLINE PLANT EQUIPMENT FOR SALE

1—800# 20 MMCF Absorber with Scrubber, etc.
1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.
2—10 MMCF LTX Units.
2—20 MMCF LTX Units.

Vessels, Generators, Pumps, Instruments, Pipe, Valves, and Fittings and Other Equipment necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

Southern Production Company, Inc.

P. O. Box 670 Phone—EDison 2-6181
FORT WORTH, TEXAS

BROWN-STRAUSS CORPORATION LIQUIDATING

PURE OIL REF., CHARLESTON, W. VA. AND BAY REF., McPHERSON, KANSAS

HOT OIL PUMPS—Simplex, Duplex, Centrifugal, 100 to 400 GPM, 100 to 1500 PSI-Steam, Electric Motor, Gas & Diesel Drives.
STEAM PUMPS, Simplex & Duplex, 22 to 500 GPM, 100 to 1500 PSI.
FRACTIONATOR, 6'-6" x 98'-0", Shell ⅝" Heads ⅞", 40 trays.
GYRO FRACTIONATOR, 6'-6" x 72'-0", Shell & Heads ⅝", 16 Trays.
CLAY TOWERS, 12'-0" x 30'-6", Shell & Heads ⅜". No Trays.
STABILIZER, 3'-0" x 55'-0", Shell & Heads ⅞" Top Hd. Flgd.
NAPHTHA FLASH TOWER, 3'-0" x 37'-6", Shell & Heads ⅜", 7 Trays.
STABILIZER, 3'-0" x 49'-0", Shell & Heads, ¾", 30 Trays.
STABILIZER, 4'-0" x 48'-0", Shell & Heads ⅝", 30 Trays.
FRACTIONATOR, 3'-6" x 56', Shell & Heads ⅜", 22 Trays.
FLASH TOWER, 7'-6" x 32'-6", Shell & Heads ⅞", No Trays.
Other Towers & Pressure Vessels, various sizes & Pressures.
Over 100 Heat Exchangers, Condensers, Reboilers, & Coolers from 80 to 1500 sq. ft. capacity. Admiralty & Steel Tubes.
Updraft Heaters, Cracking & Reformer Heaters.
Ethyl Lead Blending Unit, 8500 gal. cap. tank, complete.
Compressors, Gas & Steam Driven.
Sharpless Centrifuges, Oil Filter Presses, Chillers, etc.
Tank Plate 3/16"-¼" and ⅜"—large size sheets.
Valves—Fittings—Used Structural Steel.

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BROWN-STRAUSS CORPORATION

1546 Guinotte Ave., Kansas City Mo., Phone HA 1-1000
Field Office: Cabin Creek (suburb of Charleston, W. Va.)
Phone East Bank 5611, Roy Crisp, Mgr.
P. O. Box 2921, Charleston, W. Va.

FOR SALE EQUIPMENT

FOR SALE: 86' Oilwell Mast, with 4½ Substructure. Telephone: CE 2-6318, Oklahoma City, Okla.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FOR SALE: Slightly used Model 118 Royal Scintillator, $1250.00. Write L. E. Farley, Inc. P. O. Box 6841, Houston 5, Texas. Or phone Earl Tise, JAckson 2-3791.

FOR SALE: Single Engine Wilson Giant powered by G.M. Diesel with torque converter, Wheland pump, 87 ft. Moore Mast, Rig complete for 3,000 to 5,000 ft. drilling. Box J-523 The Oil and Gas Journal, Tulsa, Oklahoma.

HEAT TREATER—McKelvy 4' x 20'—25# WP—2" Kimray valves—350,000 BTU—rated 500 Bbls. fluid 500 MCF gas per day—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

RECORDING INSTRUMENTS, fair condition, mounted on good truck. Dual power reels and cables. Bargain. Box J-460. The Oil and Gas Journal, Tulsa, Oklahoma.

CLARK MA-4 Compressor Cylinders, complete. 7 new 13" x 8", 7 used 7¾" x 8", excellent condition. Priced to sell. Write Consolidated Gas Utilities Corporation, Box 1439, Oklahoma City, Oklahoma.

FOR SALE: 25,000 feet of 1¼", H-40, Hydril "CS", new tubing, available immediately, $1.15 per foot. Box J-553, The Oil and Gas Journal, Tulsa, Oklahoma.

5½" SEAMLESS CASING, 10 lb., 20' random, 11½ thread, good as new. $1.25. M. J. Regan Pipe Co., Coffeyville, Kans.

FOR SALE: 1—Mayhew 2000 drilling rig mounted on F-8 Ford tandem, all new motors, 2000' 2⅞" new National drill pipe 30' long. Winch truck with oil field bed, water tank, dog house on wheels, 2-wheel 10-ton pipe trailer, pick-up truck. Rig is in first class condition, all tools to drill with. Unit is now drilling in Illinois. If interested call FLanders 1-1010. St. Louis, Mo.

FOR SALE EQUIPMENT

LINE PIPE: 2500' 7" OD 17 lb. Good body, 40' random lengths. Clean, straight, beveled, ready to lay. $1.00. M. J. Regan Pipe Co., Coffeyville, Kans.

2 MAYHEW SEISMOGRAPH RIGS — 1 Model 600 mounted on 1954 F6 Ford with desired amount drill stem—4½ x 5 Gardner-Denver Pump. 1 Model 1000 mounted on 1952 F6 Ford with 300' drill stem—5 x 6 Gardner-Denver Pump. This equipment is in excellent condition. International Drilling Corporation, 314 Enterprise Building, Tulsa, Oklahoma.

FOR SALE—2 truck mounted Bettis steam units. Good condition, equipped for oil field work. Box J-332, The Oil and Gas Journal, Tulsa, Oklahoma.

100,000 FEET 4" OD x 10 gauge Line Pipe, weight 5.53 pounds per foot, 30 foot lengths, beveled ends for welding, all pressure tested to 1400 P.S.I. made to conform to API 5-L Grade A Specifications. August shipment from mill in Chicago, Illinois area, price 55c per foot F.O.B. Mill for the lot. CASH COMPANY, 9015 Wilshire Blvd., Beverly Hills, California.

COMPRESSOR BUILDING — Structural steel, 12' x 35' x 120', Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

FOR SALE: National 50 Drilling Rig Complete, for details, call or write Ralph W Shebester, Box 337, Pauls Valley, Oklahoma. Telephone 570.

J-55 TUBING FOR SALE. 7600 ft. 3½" O.D. 9.20# Range 2 S.S. Call or write P O. Box 4024, Phone FEderal 7-2145, Odessa, Texas.

GAS COMPRESSORS—3 Bessemer type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

EQUIPMENT WANTED

PIPE WANTED. We are constantly in the market for carloads of used or substandard pipe 8⅝ and upwards. Box J-534, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

WANT REPRESENTATIVE in South America for specialized line of oilfield production equipment. Commissions are far above average. Send resume giving sales outlets and sales force. Box J-491, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL SUPERVISOR
GEOLOGISTS

Fully integrated major oil company has opening for geological supervisor with 8 to 10 years experience in exploration geology in the Rocky Mountain area. Also openings for graduate geologists. Replies should furnish complete personal data, education, experience and date available. All replies confidential.

Box J-518, The Oil and Gas Journal, Tulsa, Oklahoma.

Plant
Equipment
Inspectors

Graduate engineers with minimum 5 years' experience in design or inspection of petroleum processing plants and equipment. Major part of experience must have been in inspection work entailing general knowledge of all facilities. Develop inspection methods, supervise and conduct inspections and advise operations on codes and equipment limitations in a major oil installation located in Saudi Arabia.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

Recruiting Supervisor, Box 90

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE
NEW YORK 22, NEW YORK

REFINERIES AND REFINERY EQUIPMENT FOR SALE

REFINERIES AND REFINERY EQUIPMENT FOR SALE

ANOTHER LARGE AUCTION

Formerly the W. T. Waggoner Crude Oil Company

Electra, Texas

TUESDAY, JUNE 12, 1956 — **9:30 A. M. (C.S.T.)**

Acquisition cost in excess of $4,000,000.00

Complete 6000 barrel a day crude oil refinery. Most equipment was purchased and installed since 1947, including all buildings, vessels, pumps, heaters, piping, cracking plant, stills and complete ethyl blending plant. This refinery will be offered in its entirety and if not sold as one unit will be broken down and sold piece by piece and in lots to the highest bidder, without minimum or reservation.

NOW OPEN FOR INSPECTION

For complete listing of equipment contact auctioneers.

Auction to be conducted on premises located 2 miles west of Electra, Texas on Highway 287. Electra is located 25 miles west of Wichita Falls, Texas on Highway 287.

Another Large Auction Conducted By:

WAYNE COOK ASSOCIATES, INC.

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If you are not on our permanent mailing list, please send in name and address.

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2803, Tulsa, Okla. $5.00 cash.

WANTED: Man for teaching staff and part-time research in Petroleum Engineering at Rocky Mountain School. Should have M.S. or better and some oil industry experience. State general qualifications in letter. Salary open. Jox J-517, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

SOUTH AMERICA. Major Oil Company. Our Fee paid. Engineers, all types, Drilling Production—Pipeline—Gas, B.S. Degree, no experience required. Tool Pushers, 3 to 5 years experience. Pipeline Mechanic, 5 years experience. Foreman Gas, 5 years experience. Career employment. Age to 40. All information confidential. Contact CHAS. J. LOVELESS PERSONNEL SERVICE, 616 South Main, Tulsa, Oklahoma—GIbson 7-3193.

HELP WANTED

VALUATION ENGINEER

Oil Company seeking to purchase producing oil properties desires services of petroleum engineer with experience in reservoir valuation and appraisal work. In addition to practical technical knowledge and experience, must have ability to make and develop contacts. Some experience in the ABC economics of financing purchases also desirable. This is a permanent salaried position with excellent opportunities for growth. Written reply should furnish details on education, experience, age, personal and professional references, and some idea of salary requirements. Small recent photo would be helpful.

Box J-528, The Oil and Gas Journal, Tulsa, Oklahoma.

W

AREA ENGINEERS

Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE

NEW YORK 22, NEW YORK

PETROLEUM ENGINEERS

For drilling production and equipment on varied types active fields.

EXCELLENT SALARY, ALLOWANCES, OPPORTUNITY OBTAIN ADDITIONAL EXPERIENCE & ADVANCEMENT.

Positions Available Venezuela & Colombia. Graduate Engineers—minimum 2 years exp.

Forward Personal data, college transcript, to:

C. L. LAUE

SOCONY MOBIL

OIL CO., INC.

26 Broadway, New York 4, New York

Petroleum Geologists

Established Oil Company desires geologists for employment in West Texas area. Must know area and have four to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-485,

THE OIL AND GAS JOURNAL,

TULSA, OKLAHOMA.

OVERSEAS OPPORTUNITIES

Affiliates of

STANDARD OIL COMPANY (New Jersey)

Located in

SOUTH AMERICA

... Have staff positions now open for:

MAINTENANCE ENGINEERS:
Will plan, schedule and coordinate oil refinery maintenance and construction projects and/or provide technical assistance to refinery crafts.

PROJECT ENGINEERS:
Assignments may include project development, cost estimation, materials specifications, design and drafting, and construction follow-up.

PROCESS ENGINEERS:
Work assignments may involve process design and control, economic studies, and/or scheduling of refinery operating programs.

EQUIPMENT INSPECTION ENGINEERS:
Will inspect refinery equipment and request equipment renewals when necessary due to corrosion or failure under safty codes.

PETROLEUM ENGINEERS:
Assignments will be of general Petroleum Engineering nature. Emphasis will be placed on equipment and production or cost and engineering analysis.

Engineering degree and minimum of two years experience in oil refinery or allied chemical industry required.

Liberal salaries, benefit plans, and vacation policy.

WRITE

Giving complete address, age, marital status, education and details of previous experience, Box 308-W, Radio City Station, New York 19, N. Y.

DESIGN ENGINEERS

You can fill a desirable permanent position in McKee's enlarged Refinery, Metals or Industrial Divisions. Our expansion program gives you excellent opportunity for advancement in one of the world's largest engineering firms.

World-wide McKee operation offers you wide choice in the design of Petroleum Refineries, Chemical Plants, Blast Furnaces, Steel Plants, Sintering Plants and Industrial Plants in the following fields:

Piping Layout, Structural Steel, Concrete, Process Heaters, Equipment Specifications, Layout and Process Design. Also Piping and Electrical Draftsmen.

You get top compensation, the security of a life-long pension, paid vacations, benefits of insurance, hospitalization, sick-leave pay and training program.

You'll work with modern equipment in large air-conditioned quarters. Free parking on premises.

Cleveland has attractive residential areas, excellent schools and colleges for you and your family. McKee makes generous transportation and moving allowances.

Write for an interview giving education and experience. No age limitations. All letters kept strictly confidential. Write today to:

EDWARD A. KOLNER

ARTHUR G. McKEE & COMPANY

2300 Chester Avenue

Cleveland 1, Ohio

HELP WANTED

GEOPHYSICIST WANTED: Position open for experienced seismologist, supervisory work—West Texas-Southeast New Mexico area. Headquarters Midland, Texas. Requirements eight years minimum experience; one to two years West Texas-Southeast New Mexico. In reply give personal data, educational qualifications, and details of professional experience. Box J-535, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Major Oil Company has openings in Production Dept. in Venezuela for a number of graduate petroleum engineers.

OPENINGS also for petroleum, mechanical & chemical engineers for work in drilling, pipeline & gas depts. Salary commensurate with experience.

Please send details of Experience to:

P. O. BOX NO. 35
BOWLING GREEN STATION
NEW YORK 4, N. Y.

TOP REPRESENTATIVE WANTED FOR RUBBER GOODS MFGR.

Expanding operations of Molded and Lathe Cut items to customer requirements. Currently servicing the Oil Field Suppliers with packers, etc. Rubber experience helpful but not necessary. Send confidential details to

Box J-522,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SAFETY ENGINEER

For modern, independent oil refinery located near St. Paul, Minnesota. He will report directly to the Plant Manager and be responsible for establishing and directing the safety policies and procedures for the operation and maintenance of the refinery, including a sound safety program, the procurement and maintenance of safety and fire fighting equipment, and coordination of plant design and safety.

A Bachelor of Science degree in Mechanical or Civil Engineering or equal with at least three years experience in oil refinery safety work required.

Furnish complete resume of experience and education, including salary requirements. All replies confidential. Write or apply in person:

GREAT NORTHERN OIL COMPANY
Pine Bend Refinery
P. O. Box 3596
St. Paul 1, Minnesota

HELP WANTED

INDEPENDENT OIL OPERATOR needs geologist experienced in northeastern Oklahoma. Box J-529, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER: Graduate petroleum or chemical engineer with a maximum of two years experience connected with refining operations. Excellent opportunity for advancement with a large independent refinery in the Southwest area. Salary according to qualifications. Box J-546, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING ENGINEER

Major drilling and production company has opening for young graduate petroleum engineer specializing in drilling techniques and machinery. Must have field experience in Mid-Continent area. Will work as assistant to Manager of Operations in Tulsa office. Good personality essential, age limit under 35. Give complete qualifications and education in reply.

Box J-550
The Oil and Gas Journal,
Tulsa, Oklahoma.

PARTY CHIEFS SEISMOLOGISTS COMPUTERS OBSERVERS

WORLD-WIDE SEISMOGRAPH CONTRACTING ORGANIZATION

offers technical careers to qualified experienced applicants. Highly attractive starting salaries with good opportunities for advancement within both domestic and foreign areas.

United Geophysical Corporation
POST OFFICE BOX "M"
PASADENA, CALIFORNIA

HELP WANTED

WIPING RAG SALESMAN WANTED—Must have ready contact with oil companies and users and must be well experienced, having a long association with buyers. Territory includes Louisiana, Texas, New Mexico, Kansas, and Oklahoma. Box J-542 The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEERS with minimum of four years experience wanted by expanding medium sized major oil company. Staff positions are in southwest locations. Please furnish information on degree held, detailed experience and state salary expected. All replies held confidential. Box J-536, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-300,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

GEOLOGICAL PARTY CHIEFS

Major American oil company has interesting openings for experienced Party Chiefs with assignments in Europe and North Africa.

Attractive salaries, pension plan, home furloughs and expenses provided.

Interviews will be arranged at time and place convenient to candidates.

Write giving age, marital status, education and complete details of experience.

Box 308-S
Radio City Station
New York 19, N. Y.

PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 3 - 6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resumé of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

GAS ENGINEERS

(Ages 25-38)

A major integrated U. S. oil company operating in South America has challenging career opportunities in an expanding organization for qualified natural gas engineers. Requirements include a degree in chemical, gas or petroleum engineering and 5 to 10 years of experience in gas and gasoline plant engineering and operations, design of gasoline and compressor plants, and gas transmission systems, engineering and economic evaluations of natural gas projects. Salary and bonus approximately $13,000-$18,000, depending on qualifications and experience. Liberal employee benefits and home vacations with travel expenses. Send complete personal data and experience resume. Interviews will be arranged for qualified candidates. All replies confidential.

Box 1221, Dept. F-21,
New York, N. Y.

HELP WANTED

INDEPENDENT REFINER in Mid-Continent area has opening for Assistant Plant Superintendent. Prefer graduate engineer with minimum of 5 years experience in the operation of vacuum and atmospheric distillation equipment. Box J-543, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER

Independent Oil Co., Home Office San Antonio, Texas, engaged in general production business and purchasing oil and gas properties, desires services of petroleum engineer with experience in reservoir evaluation. Position will include evaluation prospective purchases and work on present production. Practical experience in completion of wells also desirable. Excellent permanent position. Written reply should furnish details sufficient to justify call for personal interview. Suggest some idea of salary requirements, living in San Antonio. Small photo would be helpful.

BOX J-548,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

Process Engineers

Upper Midwest Refinery has openings for Chemical Engineers with up to Five years experience in process engineering, economics or operational engineering.

Please include complete resume of experience, education, salary expected and references with reply.

International Refineries, Inc.
PERSONNEL DEPARTMENT
Box 28
WRENSHALL, MINNESOTA

TECHNICAL SERVICE MEN

Graduate engineers for field technical work by company licensing and servicing petroleum refining processes. All Replies Confidential.

Box J-545,
The Oil and Gas Journal,
Tulsa, Oklahoma.

CHEMICAL ENGINEERS

For responsible staff positions in New York Office directing the work of groups of experienced engineers doing process evaluation and design, economic studies and related work on refining and crude oil handling facilities, together with supporting power plants and other utilities. Work entails occasional trips of short duration to Europe and Middle East. Chemical Engineering degree plus 5 years' process experience, preferably in petroleum.

Salary commensurate with training and work experience. Liberal benefit program. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 100

ARABIAN AMERICAN OIL COMPANY
505 Park Ave., New York 22, N. Y.

HELP WANTED

CHEMIST: Graduate chemist with a maximum of two years experience connected with refining operations. Excellent opportunity for advancement with a large independent refinery in the Southwest area. Salary according to qualifications. Box J-547, The Oil and Gas Journal, Tulsa, Oklahoma.

JUNIOR GEOLOGIST or Paleontologist. Established petroleum consultant with sample laboratory in Cuba needs inteligent, aggressive, man for sample logging, surface mapping, surface work, etc. Salary $500.00 plus use of Jeep and field expenses. Bonus and one month yearly vacation. Opportunity for training and advancement. Please send complete application with college transcript, experience, references, knowledge of Spanish, draft status, etc. Harry Wassall, Consulting Geologist 202 Sinclair Building, Calle 21 y 0 Vedado, Havana, Cuba.

RESERVOIR ENGINEERS

For reservoir studies, reserve estimation & development work on varied types active fields.

EXCELLENT SALARY, ALLOWANCES, OPPORTUNITY OBTAIN ADDITIONAL EXPERIENCE & ADVANCEMENT.

Positions Available Venezuela & Colombia. Graduate Engineers—minimum 3 years exp.

Forward personal data, college transcripts, to:

C. L. LAUE

SOCONY MOBIL
OIL CO., INC.

26 Broadway, New York 4, New York

SITUATIONS WANTED

GEOPHYSICIST—ten years interpretation and field supervision. Desire position with oil company. Box J-503, The Oil and Gas Journal, Tulsa, Oklahoma.

MR. OIL MAN: Are you looking for a young, aggressive geologist with plenty of initiative? Six years Ark.-La.-Tex. and West Texas major Co. experience. Am looking for work not a position. Box J-540, The Oil and Gas Journal.

GEOPHYSICIST: Seismic Party Chief with excellent educational and highly varied interpretational background wishes position with oil company. Box J-541, The Oil and Gas Journal, Tulsa, Oklahoma.

CPA, BBA, 34, FAMILY—diversified experience in public accounting, heavy in income taxes, top level oil accounting experience in production, pipe line, refinery, marketing, including LPG, seeks challenging position as Controller Assistant Controller, or Auditor. Available reasonable notice. Box J-533, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOL. ADV. DEG.—16 years domestic, foreign, speak Spanish, prod., eng., drill. background, desires consultation retainer, part time employment, consider full time position, qualified handle land, geol., drill., prod. John O. Allen, 5816 N.W. 58th St., Oklahoma City.

EXECUTIVE

CHIEF ASSET: Ability to develop and lead hard-working, enthusiastic team. Constructive planner with desire and ability to follow through. Active, decisive, optimistic. Enjoy travel. Skilled writer. Good appearance. Age, 48. Experience: Sales, advertising, public relations, foreign and domestic. Complete knowledge oil industry. Will relocate.

BOX J-544,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SITUATIONS WANTED

MINING GEOLOGIST employing mapping evaluation equipment on western mineral exploration desires contract with geophysical drilling organization. Box J-552, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTORNEY-LANDMAN, 32, desires position with company engaged in foreign operations. Speak German, French. Honor graduate Law. Six years experience all phases Legal and Land. Major oil company experience, Division Attorney and District Landman, emphasis on Contracts and Negotiations. Also private law practice. Presently employed. Box J-554, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST—5 plus years experience in Mid-Continent and Rocky Mts., desires Rocky Mt. or foreign employment. Family man. Resume upon request. Box J-555, The Oil and Gas Journal, Tulsa, Oklahoma.

AGGRESSIVE YOUNG CPA, age 32, desires position with independent. Experience includes controller of medium size drilling, production and exploration company, having charge of Accounting Department, Federal and State taxes, lease records and office supervision. Resume on request. Box J-551, The Oil and Gas Journal, Tulsa, Oklahoma.

MAILING LISTS

MAILING LISTS—Covering all branches oil industry. Free catalogue. Oil Industry Mailing List Co., 405 Tuloma Bldg., Tulsa, Okla.

WANTED

VENTURE CAPITAL WANTED. Financing needed for oil drilling deals in Central Oklahoma. Also want contact with investors interested in acquiring oil properties. References furnished and required. Melco Drilling Co., Box 1360, Seminole, Oklahoma.

WANTED: Financial help to drill 100 acre lease, nine sands encountered to 1400 feet. Early Pennsylvania sand 250 feet deep, 550 feet best prospects. Wells pumping on joining lease. Atoka Co., Okla. Have Rig, Truck, Tools. Box J-537, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

TO PURCHASE oil production or corporations having production for cash or stock in a listed company (or combination of both). All replies strictly confidential. Box J-412, The Oil and Gas Journal, Tulsa, Oklahoma.

COLUMNAR PADS—WORK SHEETS

DESIGNED FOR YOU!—Over 400 styles, sizes and kinds from which to choose. Sheets with 1 to 30 columns. Also horizontally-ruled sheets with no columns. Choice of Kraftbilt Green-Tint, Ivory, Canary or White Paper. Variety of sizes from 8½ x 11 to 14 x 25½ inches. Screened lines guide you without dominating entries. Ask for Catalog 855-P. Ross-Martin Co., P. O. Box 800-A, Tulsa 1, Okla.

BUSINESS OPPORTUNITIES

CAPITAL CONTACT. Will consider placing proposition requiring corporate financing on Underwriting basis. Confidential. Write Consultant, 817 51st St., Brooklyn, N. Y.

FOR SALE MAPS

NEW WILDCAT MAP
WILLISTON BASIN

Up to date Wildcat Map covering North Dakota—South Dakota—Eastern Montana—Southwest Manitoba—Southeast Saskatchewan.

All fields outlined and named. Township and Range, County Seats.

Scale 1 Inch=12 Miles
Size—54" - 54"

PRICE $12.50

Write for free brochure

Northwest Mapping Company
BOX 1234
BISMARCK, NORTH DAKOTA

ROYALTIES

HIGHEST PRICES PAID for choice oil and gas income royalties, overrides, oil properties. A. S. Berry, P. O. Box 1383, Tulsa, Oklahoma.

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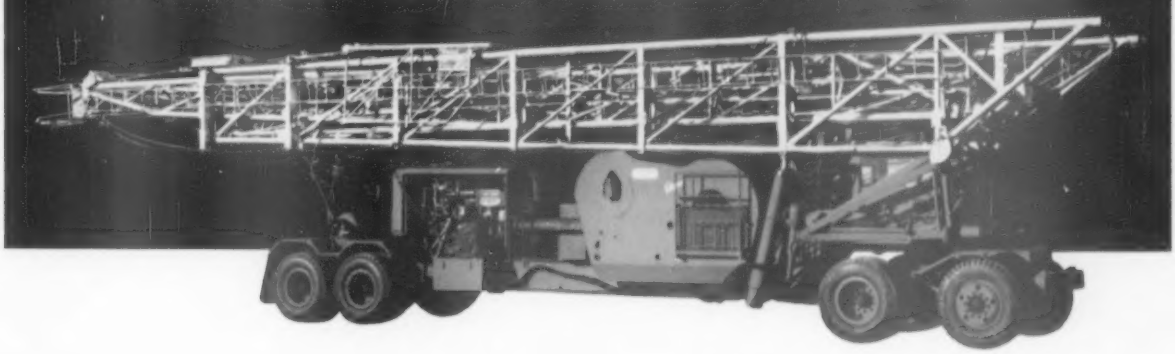

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